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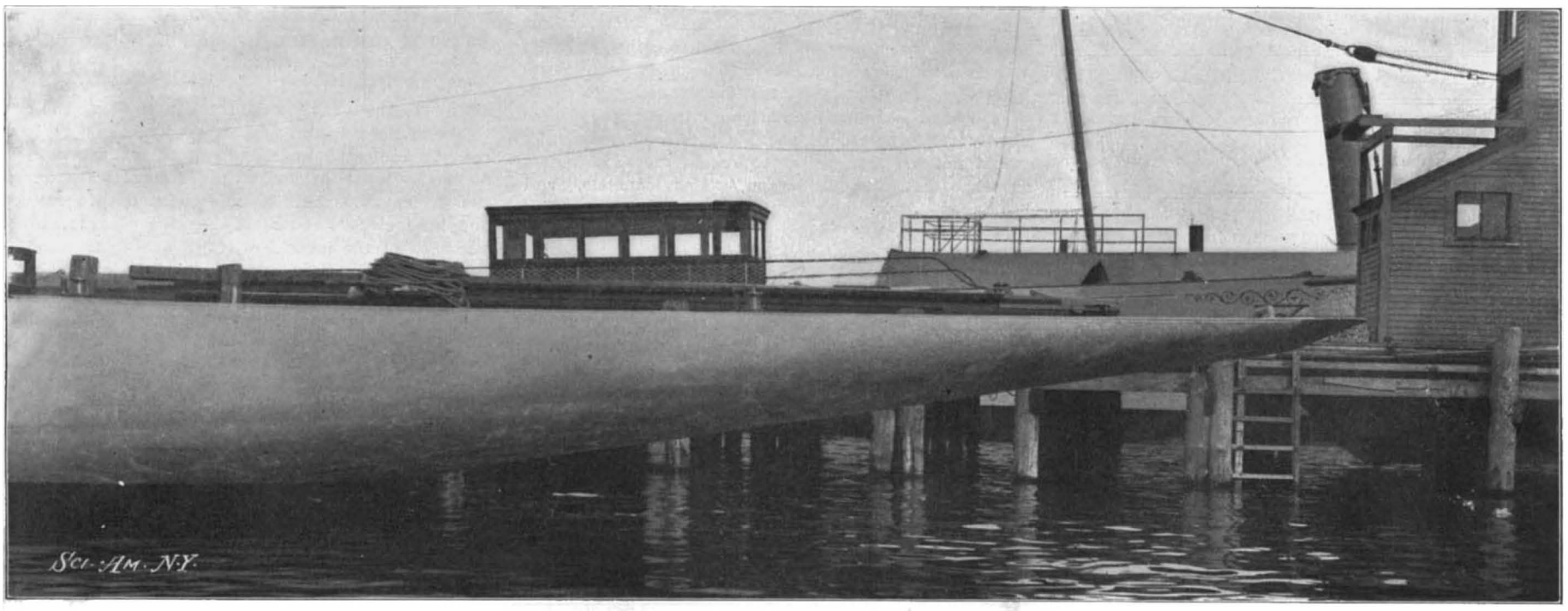
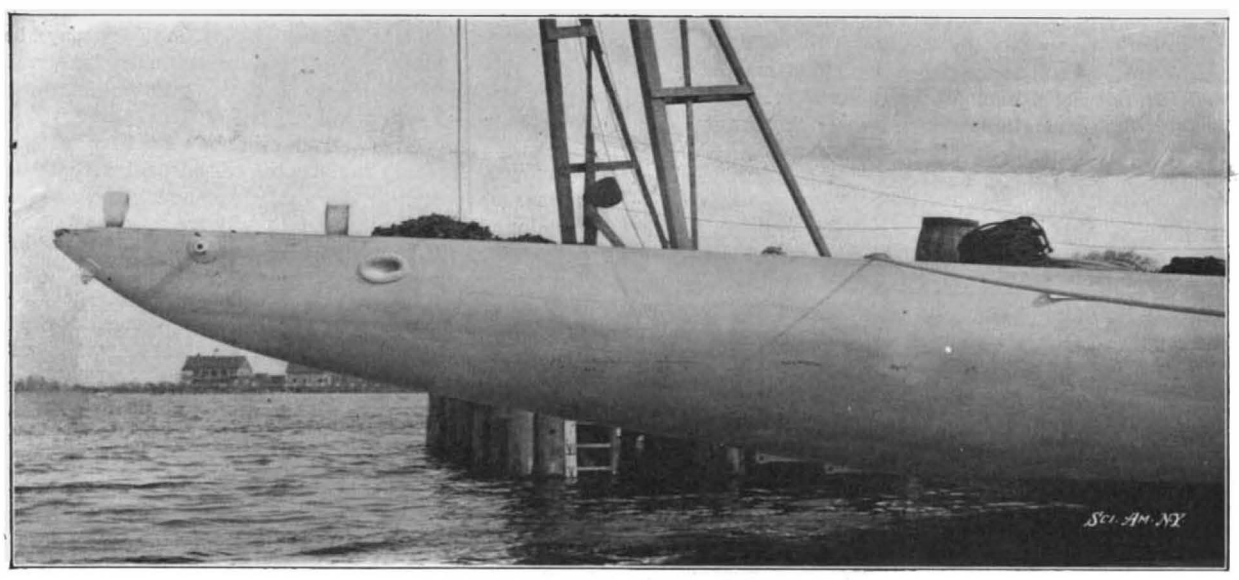
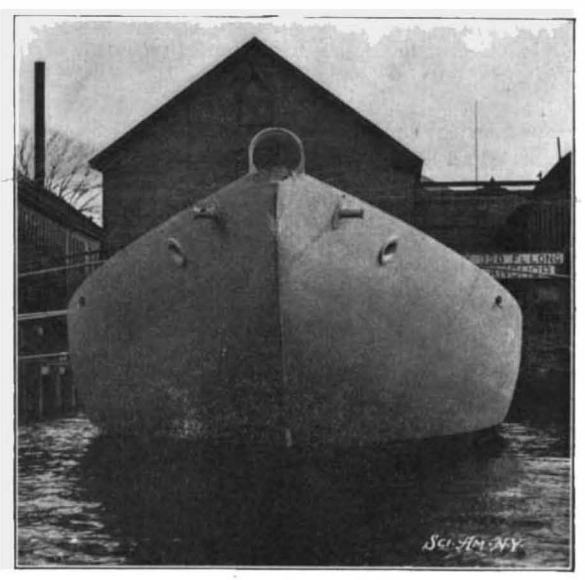


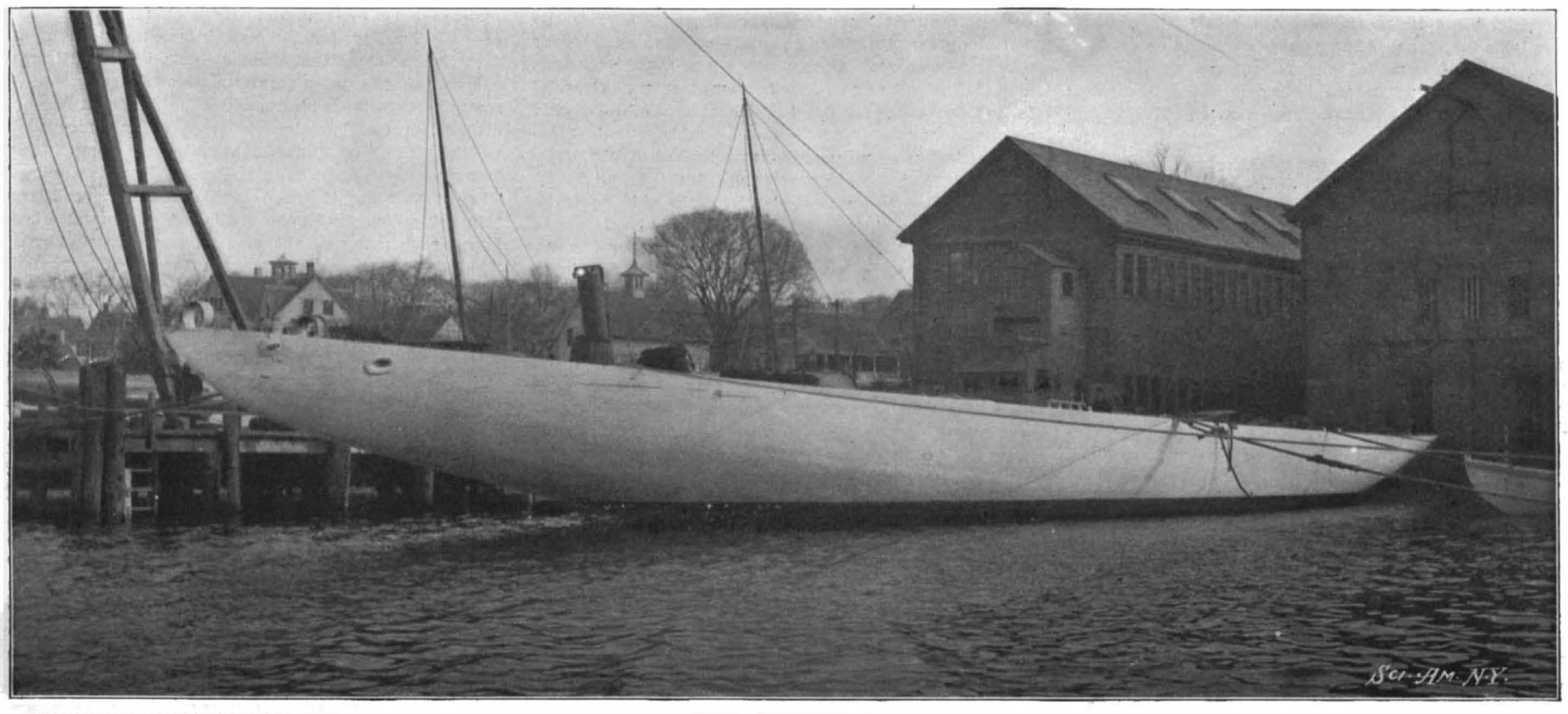
View Showing the Great Length of the Stern of "Reliance."



Broadside View of the Long Overhanging Bow.



Bow View from Dead Ahead.



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Ready for Her Spars.

THE NEW CUP-DEFENDER "RELIANCE."—[See page 314.]

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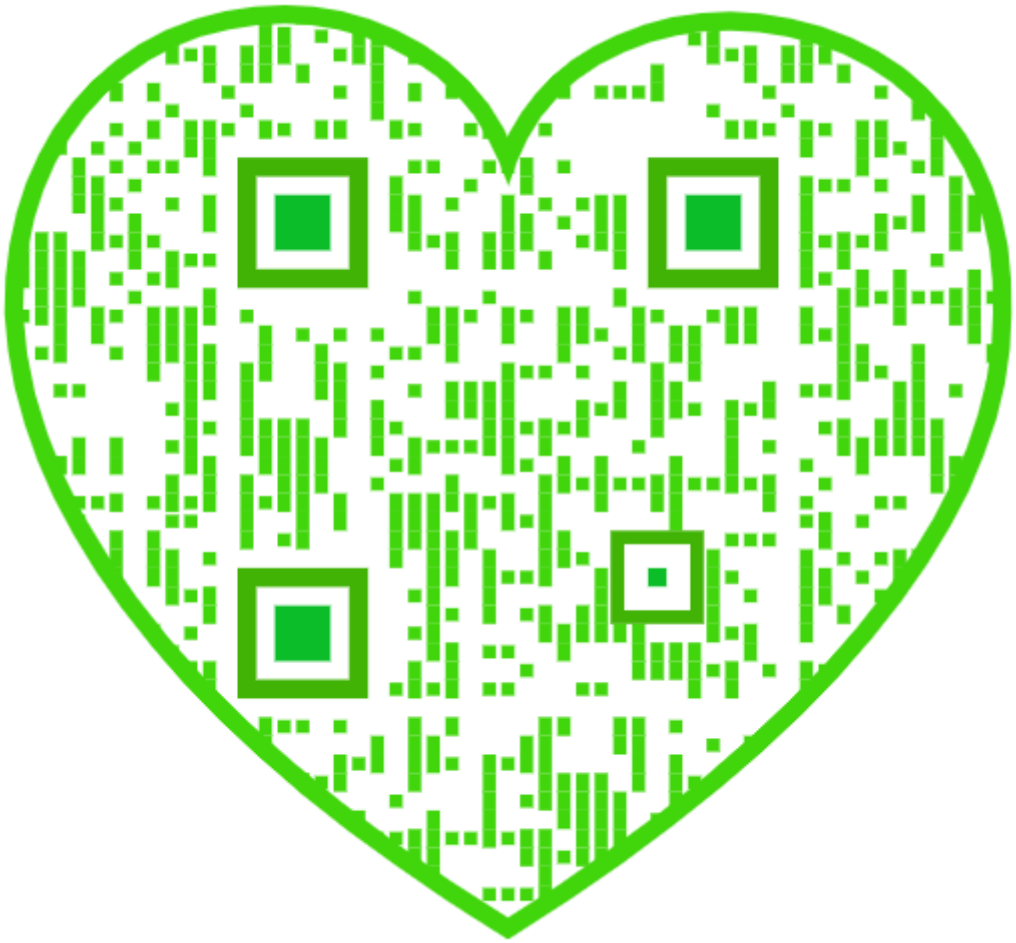

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NEW YORK, SATURDAY, APRIL 25, 1903.

The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

SHALL WE HAVE DOUBLE-DECKED STREETS?

There is many a true word spoken in jest, and when the Mayor of New York city recently said that in the endeavor to cope with the congestion of traffic we might yet come to four-storied streets, there was a kernel of truth in his hyperbole which may bear fruit much sooner than some of us expect. Indeed, we have the germ of such an idea in the existing elevated railways, and were the floor system of the elevated structures extended to the building line and suitably supported, thereby providing a roadway and a passenger sidewalk on each side of the tracks, the double-decked street would be an accomplished fact. At present, however, it is not the streets or avenues containing the electric roads that are most congested, but rather such thoroughfares as Broadway and Nassau Street, Cortlandt and Liberty Streets, where, unless some heroic measures are taken, we are bound to witness within a few years in the busiest hours of the day a positive deadlock.

The first objection that presents itself to a double-decked street is the shutting out of so much air and light, and the consequent necessity of using artificial light on what might be called the ground-floor level, except on the brightest days; but this objection could be met, and practically equal accommodations secured, by carrying the front wall of the buildings on columns, thus forming covered arcades within the building line, such as may be seen in some Continental cities. By moving the sidewalks within the building line it would be possible to give over the present sidewalks, or a certain portion of them, to street traffic. This would get rid of a large amount of crowding and obstruction of the trolley cars by enabling three teams to travel abreast on each side of the car tracks. The capacity of the street for pedestrian traffic might also be enlarged by building overhead sidewalks at the level of the first story, with stairways and cross connections at stated intervals throughout the length of the street. One immediate advantage incidental to such a scheme as this would be the great enhancement of values due to the fact that the first as well as the ground floors would be accessible to pedestrian traffic. There would be an instant appreciation of value of the first floor for shop and store purposes, while the frontage available for shop and store purposes would be doubled. The first statement of such a scheme as this may sound radical, and even chimerical; but not so much so, surely, as did the first suggestion to build an underground city railroad.

COLLAPSE OF THE GREAT SALT LAKE RAILROAD TRESTLE.

The construction of the great timber trestle across Salt Lake on the route of the Southern Pacific Railroad to San Francisco, by which it is expected to shorten the distance to that city by sixty miles, has been suddenly brought to a stop by the discovery of what has so far proved to be a deep chasm of soft material in which it is impossible to find a good bearing for the piles. The weakness of the structure was developed when the bridge recently gave way under a locomotive, which sank into the lake, drowning the fireman. In endeavoring to repair the break six 40-foot piles have been driven, one above the other, without finding the solid bed of the lake; while in the vain hope of forming a foundation 100 carloads of stone, weighing 4,000,000 pounds, were unloaded from the trestle into the soft spot without success, the mass being apparently swallowed up as were the piles. Many theories have been advanced to explain the trouble, the most likely of which is that the bottom of the lake is formed of a layer of precipitated material, and that at the point where the bridge gave way this crust has broken through, allowing the piles to pass through a deep underlying stratum of soft material. It is believed that the trestle has been located across the old bed of a river which has been filled with an alluvial deposit that is not sufficiently solid to carry the weight of the trestle. It is probable that if the engineers will only keep on dumping sufficient rock into the hole, they will in time secure a firm foundation, but it is likely to be a costly work; and it teaches a lesson as to the advisability of carrying out a system of borings before such a costly bridge work as this across Salt Lake is undertaken.

DOES IT PAY TO RECONSTRUCT BATTLESHIPS?

One of the most encouraging signs of the growing interest in the navy is the large amount of correspondence that reaches this office from all parts of the United States on naval matters. Most of this correspondence is intelligent and to the point, and it is only want of space that prevents us from publishing more of the letters received. We have before us, for instance, a communication from Boston, in which the writer asks a question which has often been asked before, and is doubtless at this very time in the minds of thousands of those American citizens who follow closely the progress of naval affairs. He asks if it would not be good policy to reconstruct and rearm the three battleships, "Oregon," "Massachusetts," and "Indiana." Briefly enumerated, his suggestions are: that the 13-inch, 8-inch, and 6-inch guns should be replaced by four high-velocity 12-inch and twelve or more 7-inch guns, thus securing a modern and more homogeneous battery and greater rapidity of fire; that the 18-inch armor be removed and 9-inch Krupp armor substituted, and that the weight thus saved be utilized to increase the engine and boiler power; he would place the vessels in dock, cut them in two and lengthen them, and so secure a knot or two more speed than they now possess, or say 18 knots an hour. Our correspondent sums up his suggestion by asking, "Would this not be a quick and economical way of securing three practically modern vessels?"

Now, while we must admit that, on the face of it, such a proposal looks attractive, yet, as a matter of fact, we would not secure "three practically modern vessels," nor would the change, even if it could be made, be economical. For, in the first place, to institute radical changes affecting the whole battery of guns and the entire motive power would in itself involve a reconstruction of the vessel more far-reaching than our correspondent for a moment imagines. As regards the guns, extensive structural changes would have to be made in the mounts, in the ammunition hoists, and in the magazines; for arrangements which were laid down fifteen years ago for the supply of ammunition to slow-fire guns, would be altogether inadequate to maintain the far more rapid flow of ammunition that would be necessary with a modern, rapid-firing equipment. This would involve cutting open decks and bulkheads, and practically tearing out a large part of the interior structure of the vessel. The increase in motive power would call for similar internal rearrangements. So also with the armor plating. Changes in the methods of supporting and fastening armor plate which have occurred during the past fifteen years, would render it a complex problem to fit the new armor satisfactorily to the old backing and hull structure. Then, again, the great changes in the disposition of weights throughout the vessel would be another complexity. Furthermore, after the new engines and boilers were in, it would be impossible to secure adequate speed results for the increased power, because the model of the "Oregon," even if she were lengthened amidships, would be uneconomical for the higher speeds. But, perhaps, the most important objection of all is that the freeboard of the "Oregon" is so low, not over 12 feet, that it would on this account alone be impossible to bring her up to modern battleship requirements, among which a high freeboard of 20 feet or more stands first. It might be answered that the molded depth of the ship could be raised by the addition of another deck; but this would require the lifting of the guns, and the heavy turrets, and would involve such a general raising of weights in the vessel that the element of stability would be seriously impaired, if not lost altogether.

No, it does not pay to remodel battleships as old as the "Oregon" class. If any remodeling is to be done, vessels should be taken in hand within ten years of their launch, and preferably even earlier than that; and even then the modernizing should go not further than the batteries, which might be improved by the substitution of more up-to-date pieces, or the insertion of submerged torpedo tubes.

Now, as regards the submerged torpedo tube, we cannot but think that some of our existing battleships and cruisers might well be supplied with this extremely valuable device, and that this addition to their armament would greatly increase their fighting value. As we have recently pointed out, the submerged tube is one of the leading characteristics in the modern warship; and we are informed, on the best authority, that it is possible to obtain accurate results and to hit the target, even when a vessel is traveling at considerable speed. One of the most important lessons of the naval war game between Germany and the United States was the fact that the possession of this device by one fleet and its absence from the opposing fleet, would at all times exercise a dominating influence in the tactics of naval warfare, and might easily at the close of a hard-fought battle enable the torpedo-armed fleet to strike a decisive blow. Of course the insertion of submerged torpedo tubes and the provision of torpedo emplacements and handling rooms would involve serious structural changes within the ship itself. It might even necessitate the sacrifice of some ammunition supply and general storage space; but it can scarcely be questioned that the sacrifices and the expense involved would be but a cheap price to pay for the enormous increase in moral and military value given to the ships in which the change was made.

THE EXTERMINATION OF THE MOSQUITO ON LONG ISLAND.

The efforts of the North Shore Improvement Association to abate the mosquito nuisance along the North Shore of Long Island have met with considerable success, as indicated by reports of their operations last summer. The purpose of the society was to study the problem so that it could point out to residents and land owners the most effective plan for the destruction of the insect.

The investigations carried on by the entomologists, Frank D. Lutz and William W. Chambers, his assistant, in the eastern section of the territory, were so thorough that they should receive more than local attention. The prevailing winds of Long Island come from the south, and as operations of the Association were confined to the North Shore, their representatives were continually met with the question, "Don't mosquitoes come to the north side of Long Island from the south side?" This question occasioned a careful investigation. Although Messrs. Lutz and Chambers were almost constantly in the field, night and day, during the entire summer, never was an independent flight of mosquitoes observed. It was quite a common sight to behold a cloud of insects follow a person walking or a vehicle driven along a road. They were also found in all railroad coaches and trolley cars of that region. These mosquitoes were always of the salt marsh variety (*Culex sollicitans*), which may be easily identified by the stripes on its body, legs, and feet. It was also observed that *C. sollicitans* was more numerous along railway trolley tracks and public roads than in places considerably removed from these highways. It could not, therefore, be denied that the salt marsh mosquito does migrate, and since it is a very long-lived insect, that it will travel considerable distances; but from the fact that its wandering depends upon the travel of man, Mr. Lutz gives it as his opinion that no large number are ever brought into a region, because a swarm, in following a team in one direction, is quite liable to return on meeting a team going in the opposite direction. Nor does he think it probable that crowds of mosquitoes are carried from one district to another by the wind, for these delicate insects would be utterly destroyed by the force of the air currents. One need but visit a marsh on a windy day to find proof of this. Mosquitoes will be discovered in large numbers, clinging for dear life to the leeward side of trees and bushes. We know also that a gentle fanning is sufficient to keep them off.

All of these facts point to the personal responsibility of each locality for its own infected condition. In fact, it is affirmed that "a single rain barrel will breed a larger number of mosquitoes than a large pond. A soggy pasture is on an average equal to about one and one-half or two barrels, and even the salt meadows," as they exist on the North Shore of Long Island, "scarcely come up to four or five good barrels apiece." The reasons for this are that the larger pools contain fish which prey upon the larvæ. It has also been found that many of the smaller pools do not breed, which is due probably to the presence of hydrogen sulphide gas. As for the meadows, they are cleansed on an average of once a month, by a high tide. The best treatment for salt meadows is, then, to dig parallel ditches about 25 feet apart, into which the surface water can drain. No mosquitoes could breed in these ditches, if they were of sufficient depth to be flushed at high tide. This plan was followed by the people of Lawrence, with complete success. In large ponds, mosquitoes breed around the shallow edges where they are out of reach of fish. The best method of treating such ponds is to deepen the shore, so as to give free access to the fishes. In one instance, mentioned by Mr. Lutz, a pond well stocked with fish was found to breed mosquitoes; the larvæ were discovered in the thin film of water contained on leaves floating about on the surface of the pond. Great care must be taken, therefore, to keep the surface of every pond free from leaves or any other floating mass which would harbor the mosquito larvæ.

In regard to the best fish for the destruction of mosquito larvæ, Mr. Lutz recommends the use of

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silver fish. Gold fish take equal rank with silver fish in efficiency, but preference is given to the latter because it is much less expensive, and also rather hardier. Next in rank are sun-fish, with mud minnows and top minnows in the order named.

The use of oil is recommended only in such cases as cannot be successfully treated otherwise. Ordinary fuel oil is the best, because it is the cheapest. Experiments with Phinotas prove it to be an exceedingly effective oil; five gallons were put around the edges of a pond about 50 feet square, and it at once cleared the waters of all life. The oil being heavier than fresh water, first sank to the bottom and then rose in minute globules which broke and spread over the surface in a thin film; the water was thus thoroughly treated from top to bottom. The pond was examined from time to time for a month, when it was found to contain only a few *Anopheles* which were about four days old. This time, then, can be taken as the average effective period of Phinotas; for although the pond had but a slight flow, a number of hard showers fell during the month.

The following suggestions, which were distributed among the residents of the North Shore, it would be well for every one bothered with mosquitoes to observe:

"By far the best method is to do away entirely with all standing water. Rain barrels are often more of a habit than a necessity; and through oversight, tubs, buckets, tin cans and a large variety of other things are often left to hold water for days at a time, and so to breed mosquitoes. Turning these bottom up or abolishing them altogether strikes at the root of the matter.

"One or two fish put in a rain barrel will live very nicely and will keep it quite free from larvæ. Gold fish and silver fish are best for this purpose, but ordinary minnows are very good.

"Another scheme is to make a covering for the barrel, so that the female mosquito cannot get in to lay her eggs. The objection to this is often that the cover is not tight enough to be effective.

"Ordinarily, rain-water is used only for laundry purposes, and in this case enough common kerosene to make a good film on the surface will be effective if renewed every week. This is easily done, but is apt to be forgotten unless some definite time is taken, as, for example, every wash day.

"Tubs for dogs, cattle, etc., may be rendered safe by *thoroughly* sun-drying them once a week.

"Utmost care should be observed in the matter of disposing of tin cans, etc. Pools in barnyards or other places should be filled up or drained. Roof spouting, where apt to be filled with leaves, needs careful attention, as do all sorts of drains. Fountains may either be well stocked with fish or the water drawn off once a week and the basins dried. Greenhouse tanks are always troublesome when present, unless they are attended to by oiling or fish. Saucers of profusely watered flower-pots and dishes or tubs of water plants form still other breeding places."

SIR WILLIAM CROOKES ON RADIUM.

The following letter from Sir William Crookes to the editor of the London Times will probably interest our readers:

To the Editor of the Times.

Sir: In the presence of a mystery like that of radium any reasonable attempt at explanation will be welcome, so I will ask your permission to revive a hypothesis I ventured to submit to the British Association in my presidential address in 1898. Speaking of the radio-active bodies then just discovered by M. and Mme. Curie, I drew attention to the large amount of energy locked up in the molecular motions of quiescent air at ordinary pressure and temperature, which, according to some calculations by Dr. Johnstone Stoney, amounts to about 140,000 foot pounds in each cubic yard of air; and I conjectured that radio-active bodies of high atomic weight might draw upon this store of energy in somewhat the same manner as Maxwell imagined when he invented his celebrated "Demons" to explain a similar problem. I said it was not difficult so to modify this hypothesis as to reduce it to the level of an inflexible law, and thus bring it within the ken of a philosopher in search of a new tool. I suggested that the atomic structure of radio-active bodies was such as to enable them to throw off the slow-moving molecules of the air with little exchange of energy, while the quick-moving missiles would be arrested, with their energy reduced and that of the target correspondingly increased. (A similar sifting of the swift-moving molecules is common enough, and is effected by liquids whenever they evaporate into free air.) The energy thus gained by the radio-active body would raise its temperature, while the surrounding air would get cooler. I suggested that the energy thus gained by the radio-active body was employed partly in dissociating some of the gaseous molecules (or inducing some other condition which would have the effect of rendering the neighboring air a conductor of electricity) and partly in originating undulations through the ether, which, as they take their rise in phenomena so disconnected as the impacts of molecules, must furnish a large contingent of Stokesian pulses of short wave-length. The shortness in the case of these waves appears to approach, without attaining, the extreme shortness of ordinary Röntgen rays.

Although the fact of emission of heat by radium is in itself sufficiently remarkable, this heat is probably only a small portion of the energy radium is constantly sending into space. It is at the same time hurling off material particles which reveal their impact on a screen by luminous scintillations. Stop these by a glass or mica screen, and torrents of Röntgen rays still pour out from a few milligrammes of radium salt, in quantity sufficient to exhibit to a company all the phenomena of Röntgen rays, and with energy enough to produce a nasty blister on the flesh, if kept near it for an hour.

In conclusion, if it is not too much trespassing on your space, I should like to express the great admiration which I have, in common with all English men of science, at the brilliant discovery of radium, and its unique properties—the crowning point of the long and painstaking series of researches on radio-active bodies undertaken by Prof. Curie and his talented coadjutor, Mme. Curie.

I remain, Sir, your obedient servant,

WILLIAM CROOKES.

In a subsequent letter to the Times, Sir William Crookes writes:

"According to the hypothesis I ventured to formulate, I have little doubt that radium would cease to show its peculiar properties in a perfect vacuum. But such experiments at present are impossible of performance. What we call a 'high vacuum' is only a vacuum by courtesy. Most experiments in so-called high vacua have been performed at an exhaustion of about a millionth of an atmosphere, at which the phenomena of the radiometer, radiant matter, X-rays, and electric non-conduction can be observed. But what does an exhaustion to the millionth of an atmosphere really mean? Practically nothing! It may seem that when the originally tenuous air is reduced to the millionth part of its bulk, so little will be left that we are justified in neglecting the trifling residue and in applying the term vacuum to space from which the air has been so nearly removed. This, however, is a fallacy due to our difficulty in grasping the meaning of high numbers. In the present case the original number is so high that division by a million appears to make a scarcely appreciable difference. For instance:

"A glass bulb similar to those used in high vacua experiments, five inches in diameter, contains more than a quadrillion (1,000000,000000,000000,000000) molecules. Now, when the bulb is exhausted to the millionth of an atmosphere, it still contains more than a trillion (1,000000,000000,000000) molecules — quite enough matter to produce all the effects demanded by my hypothesis."

"EGYPTIANIZED" CLAY.

A discovery which gives good promise of affecting the clay industry and its various branches has been made by Mr. E. G. Acheson, of Niagara Falls. While experimenting in crucible manufacture, Mr. Acheson had occasion to search for a clay possessing certain qualities. He experimented with domestic and foreign clays, and wondered why German clays were esteemed superior to American. He realized that in some manner Nature had given them different treatment; that something had been mixed with them, possibly through water, that increased their plasticity. He began a series of experiments, and gathered all the information he could in regard to clays. Among other facts that commanded his attention was the seventh verse of the fifth chapter of Exodus, which reads:

"Ye shall no more give the people straw to make brick, as heretofore; let them go and gather straw for themselves."

The twelfth verse of the same chapter and book also interested him, for it reads:

"So the people were scattered abroad throughout all the land of Egypt to gather stubble instead of straw."

Mr. Acheson secured a quantity of straw, and had it sent to his laboratory. There he boiled it in hot water, and the liquid he obtained was of dark red color. This liquid he used in the treatment of clay, and found that it was excellent for increasing the plasticity. He sought out the principle, and determined that the agent was tannin. He treated other clays with water in which tannin was in solution, and realized that he had found the secret and made a most important discovery.

The name given by Mr. Acheson to clay treated by his process is "Egyptianized clay." He has discovered that it is practicable so to treat clay and other earthy materials as to insure greater strength in the products made therefrom, also to greatly reduce the shrinkage and warping in the process of drying and baking, and also to increase the solubility and the plasticity of the material. By his process, non-plastic clays may be rendered plastic, and plastic clays made more plastic by treatment with tannin or an agent having the astringent tannin principles.

It has been found, not only by Mr. Acheson, but by experts of the highest standing in the country, that clay so treated is changed in a most remarkable manner. So little as one-half of one per cent of tannin develops a wonderful effect, requiring 13 per cent less water to make the clay soft. The maximum effect of the process and treatment, however, seems to be obtained by the use of two per cent of tannin in a ten-day treatment. The treatment consists merely in keeping the clay wet with water, so that tannin is dissolved. In the burned form the strength of the clay is increased 50 per cent, while in the sun-dried form it is increased in tensile strength 350 per cent. Tests on several clays show this to be true. It is also observed that the Acheson treatment removes the crackling tendencies of many clays. In cases where clay articles are to be made of a certain size, they can be made more exact by the Acheson process, as there is less shrinkage. All parts intended to carry loads may be greatly increased in strength, while there is decreased porosity. Many of the plastic clays are off color, but non-plastic clays of desired color will be brought into service by the Acheson process. As the sun-dried clay is made stronger than the burned article, it is evident that there will be a big saving in coal bills. In making glass pots it now takes months to "age" or temper the clay, while with the Acheson process the maximum effect is obtained in a ten-day treatment. It is told of the Chinese that the people of one generation prepare the clay for the use of the next, all of which time is spent in making the clay plastic. Under the Acheson process the results are said to be more pronounced in ten days than obtained by old methods in years.

SCIENCE NOTES.

Horseshoeing has evidently been reduced to a science. At least that is what we may infer from the fact that the National Association of Master Horseshoers intends to establish a college devoted to the trade. The purpose of the institution, it must be confessed, is admirable. A course in horse anatomy, the study of elementary chemistry and metallurgy, and the rudiments of veterinary surgery are to be included in the curriculum.

Recent British Admiralty charts give the eastern limits of the Gulf Stream in different months as follows:

January: The stream does not reach to the eastward of 20 deg. W. and a southeasterly set is apparent off Ireland.

February: In latitude 55 deg. N. it reaches 15 deg. W.; a southeasterly set is found to the westward of Ireland, etc.

March: It has advanced to the coast of Ireland.

April: In 55 deg. N. its limit has receded to 20 deg. W. and the Iceland south-going current begins to show itself north of 55 deg. N.

May: The Gulf Stream and Davies's Strait cold current commingle in 47 deg. N., 27 deg. W., etc.

June: Gulf Stream to 15 deg. W. in 52 deg. N.

July: To the south of 56 deg. N. it joins the Iceland and Denmark strait current in about 48 deg. N.

August: It extends to the north of Ireland.

September: It extends to the north of Scotland.

October: It is found in 10 deg. W. at 59 deg. N.

November: The stream is traceable to 19 deg. W. in 59 deg. N.

December: It is difficult to trace the stream east of 40 deg. N. in 45 deg. W.

Prof. F. D. Baker, a noted biologist, who is connected with the Stanford University, of California, has just returned to San Francisco from an extended trip to Central America, where he has made a very careful study of the forests of Nicaragua. The most important discovery made was the finding and classification of a tree from which a substitute for cork has been derived. Prof. Baker found the woods of Nicaragua to contain three hundred distinct varieties of trees. For the last few years a bark which is a good substitute for cork has been shipped to the United States, but it has never been scientifically ascertained from what species of tree this bark has been obtained. Prof. Baker found that the bark came from the roots of the *anona*, a tree that very closely resembles the ordinary cottonwood of the United States. The *anona* grows along the watercourses and in the lowlands. Specimens were brought back of the fauna of the western slopes of the Coast Range in Nicaragua. Prof. Baker, while absent, made a careful investigation of the various diseases to which coffee and the coffee plant is liable in Central America. On this important subject, as well as the matter of his very interesting tree and biological discoveries, Prof. Baker will soon submit a somewhat elaborate report.

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POWERFUL RAILROAD WRECKING CRANES.

The remarkable increase which has been made in recent years in the size of rolling stock for the equipment of American railroads has necessitated the construction of wrecking appliances on an equally extensive scale.

Wrecking cranes are now constructed ranging as high as over 50 tons capacity, but they can be manipulated so dextrously that even greater weights can be moved if desired. The 50-ton type is not intended to lift the complete locomotive which is now in use in passenger or freight service, for example, but can readily handle the engine when stripped of what might be called its movable parts. It is of such a capacity, however, that it can transfer a loaded freight car of the largest size as far as its arm will allow it to reach. The plan of construction of the 50-ton crane is quite similar to that of the smaller sizes, but upon the body of the platform car supporting it is mounted a steel bed weighing nearly 8 tons. Upon this casting the jib thrust travels on a roller path. To the outside of the crane are fastened the boxes for the shafts which operate the hoisting mechanism, as well as those for the shafts which vary the radius of the jib and slew the crane. The power is furnished by double engines, each having cylinders 9 inches in diameter by 12-inch stroke. The boiler is of the vertical type, being 50 inches in diameter and 9 feet in height. The crane can be operated either with or without the hook and block, and is provided with from 75 to 100 feet of wire rope, so that it can handle weights at this distance, although, when necessary, another line can be bent on in case the crane cannot be moved sufficiently near the weight to be handled. Additional stability is given the car by a system of telescopic outriggers, under which can be placed jacks supplied with the machine. This type of crane will lift 50 tons at a jib radius of 20 feet with the jib in position, while its weight in working order is about 77 tons.

Another type of crane which is favored for wrecking purposes is what is known as the double crane. As its name implies, it consists of two single cranes mounted on a platform car, each being operated independently of the other if desired. The average size of this type represents 40 tons total lifting capacity, but this can also be increased if desired. The double crane is especially available when it is desired to distribute lifting power to more than one portion of a weight. An interesting illustration of the work of this apparatus was recently given on the Pennsylvania Railroad near Pittsburg, where a passenger train was not only derailed, but several cars and the engine thrown down an embankment into the river whose course lies parallel with the tracks. The locomotive went so far into the water that but a few inches of the cab were left exposed. The nearest wrecking crews were immediately summoned, and as the locomotive was not extensively damaged, it was decided to pull it out of the river if possible, and place it upon trucks to be hauled to the repair shop. A double crane was brought into service. One of the cranes was attached to the rear end of the locomotive by a hook connected with a block and tackle, which in turn was fastened to the crane by wire ropes. The other crane was connected by a single wire cable to the forward portion of the engine. Steam was turned into the cylinders, and the weight, which represented over 50 tons, was hoisted out of the river and up the bank without difficulty, the bank forming an incline which assisted in the movement. Although, as already stated, the cranes represented but 40 tons lifting capacity in all, they were so skillfully manipulated that the engine was righted and placed upon the trucks.

RAILROAD WRECK NEAR PITTSBURG. DOUBLE CRANE HAULING A 50-TON LOCOMOTIVE FROM THE RIVER.

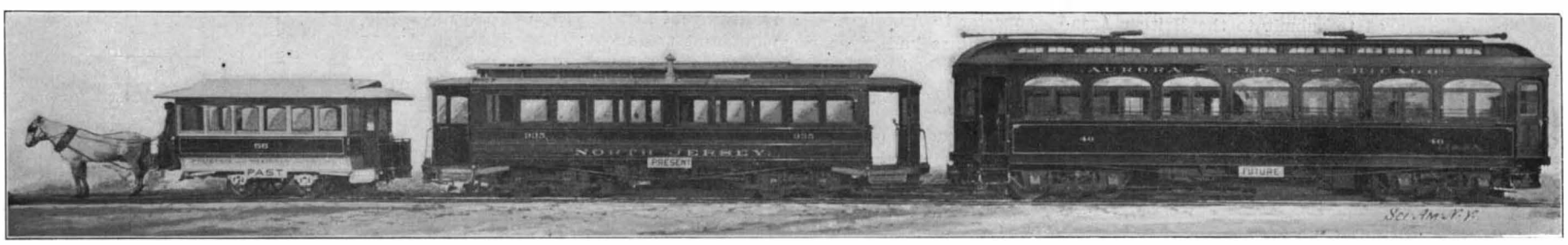
PAST, PRESENT, AND FUTURE OF THE CHICAGO, AURORA, AND ELGIN RAILWAY.

In the upper illustration three styles of cars for street railroad service are represented. That on the left is the familiar horsecar of only a few years ago. The type is still built, and the car photographed is one of a lot recently shipped to the city of Merida, Mexico. The design is one which represents the latest achievement in horsecar practice, although for northern climates a raised roof would usually be added. Street cars of this general design, and mounted on the running gear illustrated, were once in common use throughout the United States.

The central car is one with which the public is generally acquainted. It is the standard high-speed city and suburban electric car of the day. Most residents of New York who have had occasion to go to New Jersey have had experience with the speed and easy-riding qualities of these North Jersey double-truck cars. Large, comfortable, and roomy, they are apparently all that could be desired, and are now the latest thing in street railroading. They represent, very perfectly, the "Present."

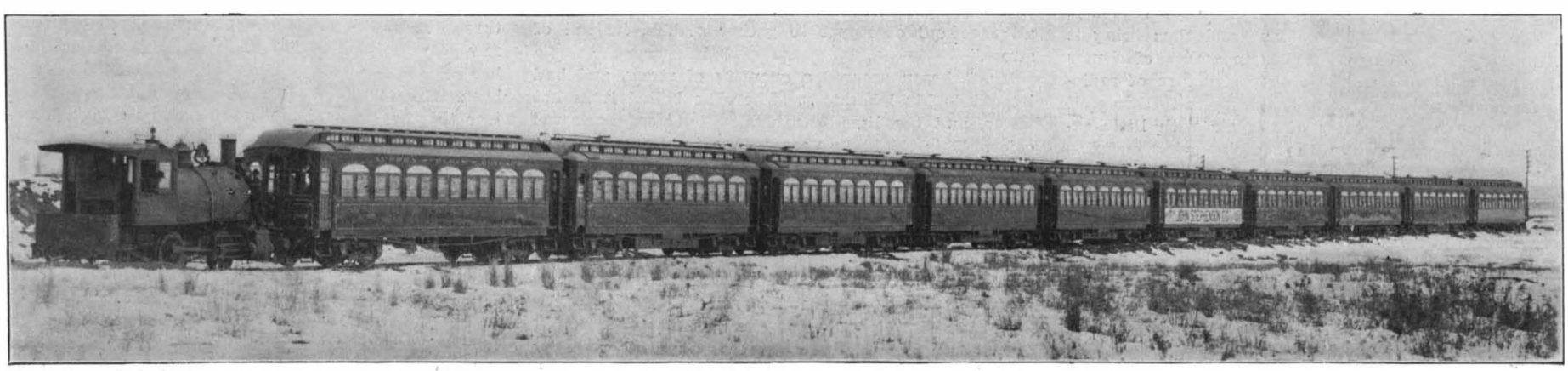
The car on the right shows what we may expect in the immediate future. It is one of a large number in course of construction for the Aurora, Elgin, and Chicago line. A car of this type recently ran from Chicago to Aurora—a distance of 35 miles—in 34 minutes, or at a speed of nearly 62 miles an hour, including several slow-downs. The lower illustration represents the first shipment of ten of this type of cars, built by the John Stephenson Company. The floor frame is of steel, on which a body of wood is mounted. There are two compartments in each car, one of which is the smoker, and the other for the ordinary passenger service. Between them comes a toilet room. The ends are completely vestibuled, and arranged in a manner somewhat similar to those of steam coaches. For the interurban service the third rail is used, but within the city limits, where they use the street railroad tracks, the cars are provided with the usual trolley pole at each end. Running, however, in pairs, they are all provided with end entrances. The cars without electrical attachments are used as trailers. These cars have been designed and built to maintain a speed of 70 miles per hour and upward.

The Delaware & Lackawanna Company has made preparations to establish a great electrical power house at its Hampton colliery in Keyster Valley. Power will be supplied to the sixteen colleries in that region. About a thousand mules and many drivers and other employes will be dispensed with. Instead of oil lamps, electric lights will be used. The Lackawanna has for some time been experimenting with electric drills and cutters in its Bellevue colliery, and has found them to work in an eminently satisfactory manner. It has an electrical breaker at the Auchincloss colliery, Nanticoke, which has given the utmost satisfaction, and it is only a matter of a short time before electric breakers will be established throughout the company's entire system.



Past. Present. Future.

THE EVOLUTION OF THE CHICAGO, AURORA, AND ELGIN RAILWAY.



FIRST SHIPMENT OF HIGH-SPEED ELECTRIC RAILWAY CARS FOR THE AURORA, ELGIN AND CHICAGO RAILWAY.

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MODERN DEVELOPMENT OF THE STEAM TURBINE.

BY FRANK C. PERKINS.

Lately there has been a vast amount of work done both in this country and in Europe in connection with the development of steam turbines. That the most prominent engineers in England, Germany, Switzerland, France, and America have unbounded faith in the future of the steam turbine, particularly in connection with electrical power plants, is shown by the fact that the greatest electrical manufacturers in each of these countries have recently taken up this type of steam prime mover, and are now installing turbo-dynamos in sizes up to 5,000 kilowatts. It is not surprising that the steam turbine is meeting with such favor, when its high efficiency, its low cost, and the small space it occupies are compared with the high-power, slow-speed steam engines which are now directly connected to enormous fly-wheel alternators. It is frankly acknowledged by eminent steam and electrical engineers that there is a great probability that the immense compound and triple-expansion slow-speed engines, with their large revolving field alternators, which have been so extensively installed up to the present time, will soon become obsolete, their place being taken by the comparatively small steam turbo-alternators now being developed by the leading American and European manufacturers.

The Rateau steam turbine is being introduced in France by Sautter, Harle & Co., of Paris, and in Switzerland and elsewhere by the Maschinenfabrik Oerlikon, of Oerlikon, near Zurich. The steam turbine designed by Prof. Rateau consists of a number of Laval or Pelton wheels arranged in series on a shaft, each of which revolves in a separate chamber, and the whole forming a multiple-step impulse turbine, the steam being conveyed to the vanes on the wheels by distributing nozzles which are fixed, and the expansion taking place in the latter. There are two sizes of wheels in the turbine, one of a system of fifteen smaller wheels, and another of ten wheels which are larger in diameter. The steam leaves each of the chambers at but little lower pressure than that at which it enters, the impulse due to the velocity of the steam particles being imparted to the vanes, while there are no close fits, but still no great tendency to leakage. The Curtis steam turbine, which is being developed in America by the General Electric Company, also employs a series of impulse wheels for obtaining the necessary moderate speeds required. This turbine in a thoroughly practical and highly efficient state is said to be about ready to be placed upon the market, and its great simplicity, small size for a given output, and low cost in comparison with the large steam engines now in use, bespeak for it a great future. A horizontal type of the Curtis steam turbine has been in operation for some time at the power house of the General Electric Company, at Schenectady, and it is fair to suppose that its efficiency and general operation have been highly satisfactory, as a number of steam turbines are now being constructed by this company in their works in sizes up to 5,000 kilowatts. These turbines are of the vertically revolving type, the alternators being mounted on the top of the same. The floor space occupied by the 5,000 kilowatts unit, as well as the size of the alternator direct connected to the turbine, are so small as to cause wonder to the engineer when gazing at the same time at the 60-foot revolving field alternator, supplying only 3,500 kilowatts at 70 revolutions per minute.

The buckets of these steam turbines are cut from the solid steel by a specially designed machine tool, instead of being fastened to the revolving part by mechanical means. The turbine was invented by Charles G. Curtis in 1896 and 1897. In the application of Mr. Curtis of August 4, 1896, he says: "The object I had in view is to produce an elastic-fluid turbine in which the steam is delivered simultaneously to an entire annular range of relating vanes. This I accomplish by the employment of an annular delivery-nozzle expanding or diverging in the direction of flow of the fluid and converting the pressure of the fluid largely into velocity before it strikes the first set of movable vanes. The movable vanes consist, preferably, of two or more sets mounted upon the periphery of the drum and separated by intermediate annular sets of stationary vanes which are mounted upon the shell. The annular working passage—i. e., the passage through the movable and stationary vanes between the discharge of the nozzle and the exhaust—is enlarged or expanded in the direction of flow of the fluid, so as to accommodate, without choking, the increased velocity as it progresses and also to compensate for and overcome the effects of frictional retardation and the tendency to reconvert velocity into pressure by eddy-currents, etc."

The elastic-fluid turbines patented by Mr. Curtis, under date of September, 1897, are adapted to be used either as condensing or non-condensing engines, by utilizing the elastic fluid at different ratios of expansion. In one of these designs, his turbine is divided into two parts, mounted upon a common shaft, one of such parts being adapted to convert into *vis*

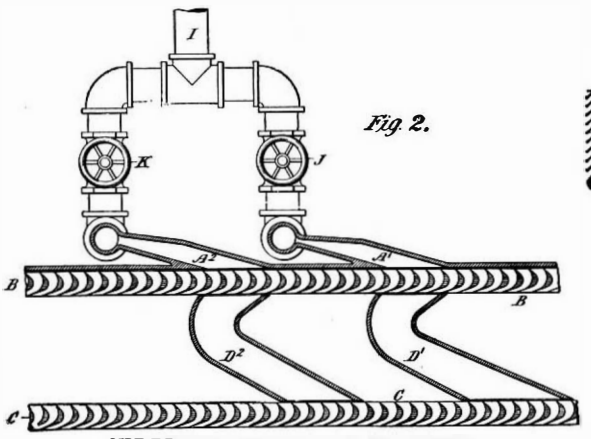
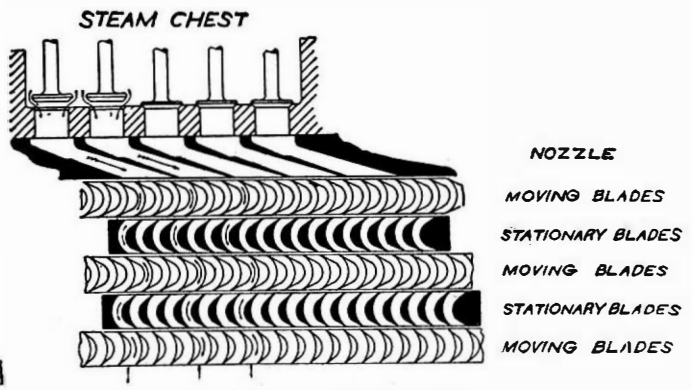


Fig. 2.

CURTIS ELASTIC-FLUID TURBINE.



SECTION SHOWING FIXED AND MOVING BLADES.

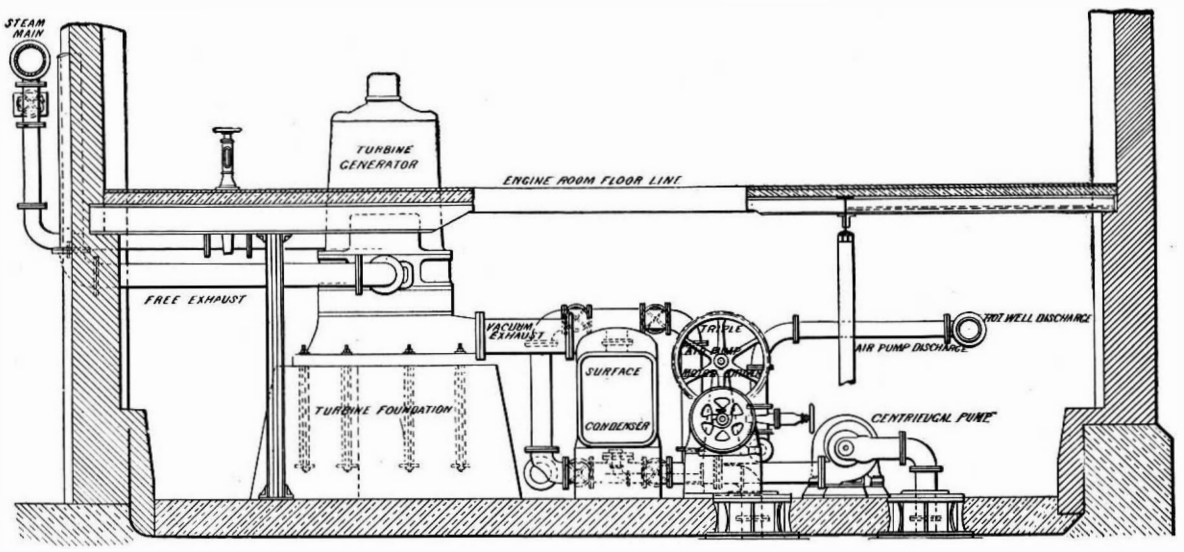
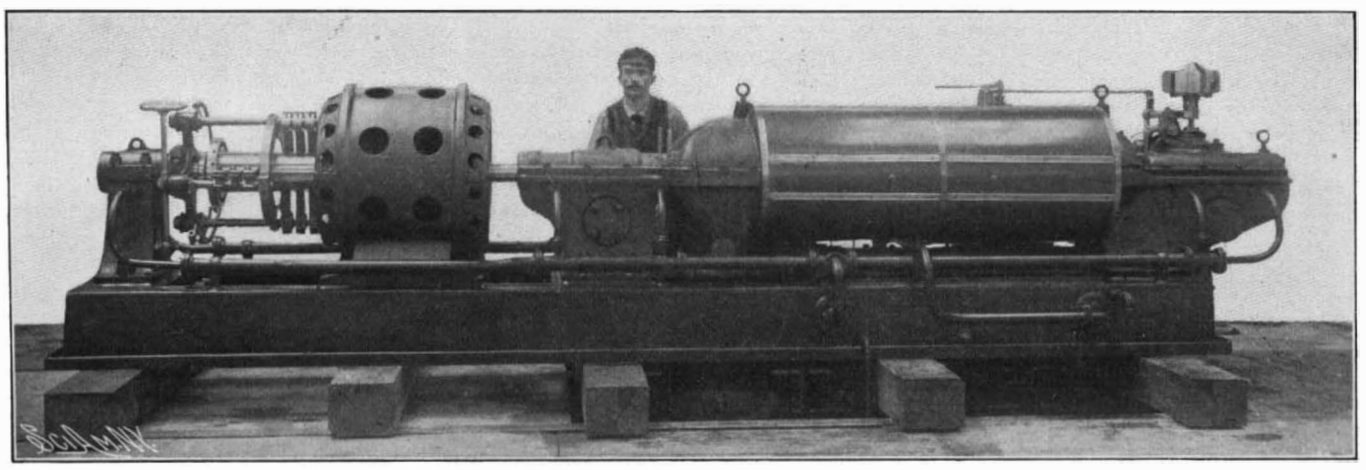
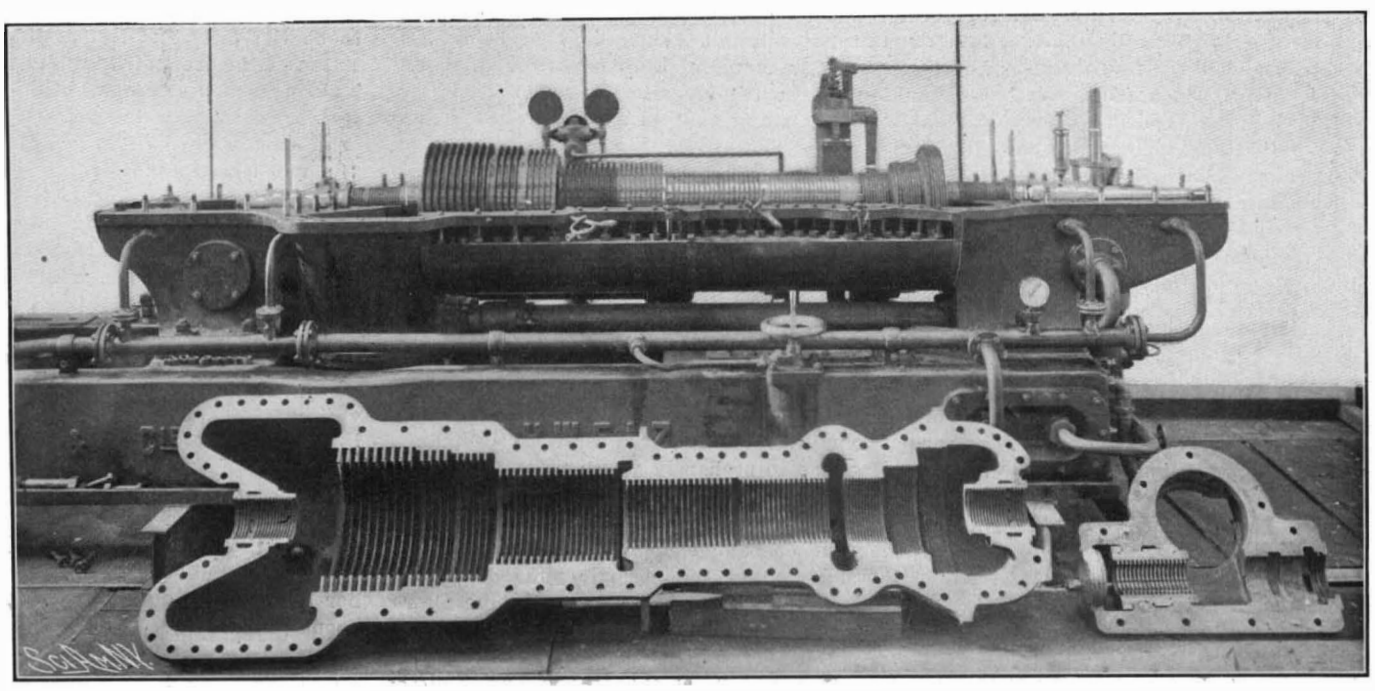


DIAGRAM SHOWING SMALL FLOOR SPACE OCCUPIED BY THE CURTIS VERTICAL TURBINE.



PARSONS 100 K. W. CONTINUOUS-CURRENT TURBO-DYNAMO; 220 VOLTS; 3,500 REVOLUTIONS.



A PARSONS TURBO-DYNAMO WITH UPPER CASING REMOVED.

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viva the pressure of elastic-fluid from the initial pressure down to approximately atmospheric pressure, and to transform it into mechanical power, and the other part is adapted to convert into *vis viva* the pressure of the elastic fluid from atmospheric pressure down to the pressure of a vacuum-exhaust, and to transform the same into mechanical power.

The Massachusetts electric companies are to install Curtis turbines and generators built by the General Electric Company in units of 500 kilowatts and 2,000 kilowatts with a total output of more than 30,000 horse power in their new power stations. The 3,000 horse power Curtis vertical turbines to be installed operate at a speed of 750 revolutions per minute, the steam pressure at the nozzle being 175 pounds per square inch. The alternators mounted upon the top of the steam turbines and directly connected generate a three-phase current of a frequency of 25 cycles and a pressure of 13,000 volts. The 1,000 horse power turbines operate at a speed of 1,800 revolutions per minute and have a total height of about 12½ feet, including the generator, while the diameter at the base is 7 2-3 feet. The alternators driven by the Curtis turbines at the Newport Station are three-phase machines and generate a current of 2,500 volts pressure, the capacity being 500 kilowatts. The diagram on the preceding page shows the general outline and small floor space occupied by the vertical turbines and alternators. The total height from the bottom of the foundation is about 18 feet, the foundation being 5½ feet high and 11 feet in diameter at the base. It is of brick construction and 9 feet in diameter at the top while it rests upon a cement bed 1½ feet thick. The Newport Station is designed to have four steam turbo-alternators of 1,000 horse power each, which will be supplied with steam from Aultman & Taylor water-tube boilers. The steam enters the top of the turbines and exhausts from the bottom through a pipe 1 foot in diameter. The plant will be utilized as an electric railway power house as well as for supplying current for lighting.

The large 2,000 kilowatt General Electric turbo-alternators weigh about 95 tons each and have a total height of nearly 20 feet, the diameter at the base being 12 feet. These machines, generating a three-phase alternating current of high potential, are capable of taking care of an overload double their normal output for a short time, and the turning moment is far superior to that of the ordinary slow-speed fly-wheel engine generator. These machines are to be installed at power stations owned by the Massachusetts Electric Companies at Danvers, Mass., Quincy Point, and Fall River, each having a capacity of about 10,000 horse power. The current will be utilized for operating several hundred miles of electric railway on the Boston and Northern and Old Colony Divisions, now taken care of by a score of small power stations.

The saving of space in a large power station using the vertical type of steam turbo-alternators will without doubt be even greater than when the long horizontal turbo-alternators are employed. A comparison of the space required by a 100,000 horse power plant using the General Electric turbines and the immense vertical and horizontal compound and triple expansion slow-speed engines and revolving field alternators of large diameter, will go a great way toward the adoption of these new high-speed units. This is especially true in power stations where the cost of land is very high, and the other savings of the steam turbine, such as oil, labor, and repairs, should make the brilliant future of this new and yet old prime mover a fact. From all accounts the efficiency is also equal to or greater than the best reciprocating engine, especially when the highest superheated steam is used.

The Parsons steam turbine is being developed and introduced in America by the Westinghouse Electric and Manufacturing Company, and in England by the British Westinghouse Company as well as by C. A. Parsons & Co., while in Switzerland it is being manufactured by Brown, Boveri & Co., of Baden (Aargau).

In America a number of 300-kilowatt steam turbines have been in successful operation for some time in the power plant of the Westinghouse Air Brake Company. These machines operate at a speed of 3,600 revolutions per minute, and are directly connected to bipolar alternators, having a frequency of 60 cycles per second. Among the many other installations of the Westinghouse-Parsons steam turbo-alternators may be mentioned those at the power plant of the Hartford Electric Light Company. These consist of 2,500 horse power Parsons turbines directly connected to Westinghouse 1,500-kilowatt 60-cycle 2-phase alternators. These are six-pole machines supplying a current of 2,400 volts, and operating at a speed of 1,200 revolutions per minute. The weight of the revolving part is 14 tons, while the total weight of the unit is 90 tons, and its length nearly 34 feet.

Among the important plants in England in which Parsons steam turbines have been in successful operation for some time, should be mentioned the four 75-kilowatt units in the original Fourth Banks Station, each of which operates a 2,000-volt single-phase alternator, having a frequency of 80 cycles per second. The satisfactory operation of these sets resulted in the installation of a number of other turbo-generators in this plant having a total capacity of 3,000 kilowatts. These machines were of various sizes up to 500 kilowatts each, the dynamos being of both direct and alternating current types. In the new Close works of the Newcastle and District Electric Lighting Company, several turbo-dynamos, having a capacity of 1,000 kilowatts each, have been installed, while provision is made for increasing the capacity to 12,000 kilowatts. These 1,000-kilowatt Parsons turbines operate at a speed of 1,800 revolutions per minute, and are directly connected to two continuous-current generators supplying direct current at 500 volts pressure.

The sizes of the steam turbine unit have been rapidly increasing, and many are now being constructed both in this country and in Europe for an output of 5,000 kilowatts each. The British Westinghouse Electric Manufacturing Company are now building and installing a number of these large units, driving three-phase alternators, which supply current at 10,000 volts pressure. These machines will be utilized in the electric generating station of the Metropolitan Railway of London, the current being transmitted to various substations, and there changed by rotary converters to a continuous current for use on the railway motors.

The Brown-Boveri-Parsons steam turbines and dynamos have been quite largely installed in Europe and range in size from 100 kilowatts to 2,000 kilowatts. One of the smaller units consists of a 100-kilowatt continuous-current dynamo directly connected to a Parsons turbine operating at a speed of 3,500 revolutions per minute. The generator supplies a direct current of 220 volts and is very similar to ordinary direct-current machines, except that a small number of poles are employed, and the diameter of the machine is small, while the armature is much longer than with ordinary direct-current types. It has been found difficult to construct a machine which will not spark at variable loads, on account of the small number of poles and high speed required. The Swiss engineers, however, have overcome this difficulty by employing a compensating winding which counteracts the magnetic field produced by the armature winding.

In a comparison of a 400 horse power steam turbine and a compound steam engine of about the same output, it was found that the steam consumption per kilowatt hour was 10.5, with an output of 400 brake horse power for the steam turbine, while the steam consumption per kilowatt hour was 12.25 kilogrammes with the steam engine, the output being 420 brake horse power. The steam engine operated at a speed of 150 revolutions, and had an efficiency of 86 per cent, the output in kilowatts being 284, while with the steam turbine at full load, the output was 270 horse power. The curves and data of this test also show that the steam turbine when operating at half load, or 200 horse power, had a steam consumption of 11.4 kilogrammes per kilowatt hour, while the compound steam engine, with an output of 211 brake horse power, had a steam consumption of 13.3 kilogrammes per kilowatt hour. In a similar test, comparing a 600 horse power compound steam engine with a steam turbine of the same capacity, operating an alternator of 400 kilowatts capacity and 2,000 volts, it was found that the steam engine had a steam consumption of 13.4 kilogrammes per kilowatt hour, the output being 670 horse power and the speed 125 revolutions per minute. The steam turbine operating at a speed of 3,000 revolutions per minute, with a pressure of 7.5 atmospheres, had a steam consumption of 10.5 kilogrammes per kilowatt hour, the output being 600 horse power. The steam consumption of the compound engine at half load, or 305 horse power, was found to be 16.2 kilogrammes per kilowatt hour, while the steam turbine had a steam consumption of 12.8 kilogrammes per kilowatt hour, the load being 300 horse power. The curves of the comparison of steam consumption of the turbine alternator and generator driven by reciprocating engines show that the steam consumption at practically all loads was greatly in favor of the steam turbine, while the actual steam consumption for the steam turbine was in nearly every case lower than that guaranteed by the Swiss engineers.

The amount of oil used in lubricating a steam turbine is very much less than that needed for ordinary steam engines, as the bearings are practically the only portion of the outfit which require lubrication. The actual cost of the oil for even the largest units is guaranteed to be so small by the best makers of steam turbines, as compared with the oil required for the high power steam engines, as to be hardly worth mentioning.

The governor on the Parsons steam turbine, as constructed by the Swiss engineers, is very close in its regulation. The effect of the Parsons governor is to change the duration of the periodic puffs of steam. According to the tests of a 400-kilowatt turbine alternator, it was found that the sudden dropping from three-quarter load to no load caused a variation of but about 2½ per cent in the speed. The variation in voltage when this alternator was supplying about 200 kilowatts and suddenly was operated at no load was only about 80 volts in 2,000, the speed being increased only about 30 revolutions, with a normal speed of 3,000 revolutions per minute.

LAUNCH OF THE "RELIANCE."

Contemporaneously with the publication of our special Yachting and Automobile number, the new cup defender "Reliance" was having her first taste of salt water, and the new challenger "Shamrock III." was engaged in one of her most successful trials against "Shamrock I." In the issue referred to, we so fully described the design and construction of "Reliance," that it is not necessary to do much more now than point out how completely the photographs of the boat which we herewith publish agree with that account of the yacht.

The events of the yachting seasons of 1901 and 1902, and the performance of certain very successful racing craft in those two years, notably the cup yacht "Independence," and the sister boats "Neola" and "Weetamoe," which more than saved their time on the Herreshoff 70-footers last year, rendered it pretty certain in the judgment of the yachting "sharps" that, when the folding doors of the Herreshoff building shed were opened, there would pass out through them a vessel of very extreme type. Consequently the exaggerated proportions of the forward and after overhangs of the new boat, as shown in our illustrations, caused no surprise, even though they are the work of such cautious and conservative builders as the Bristol firm.

In view of the rather demonstrative merriment which greeted the appearance of "Independence," with her hard turned bilges, her blunt forward and after waterline, and her huge overhangs, each some 25 feet in length, it must have been something of a shock to the critics to witness, sliding down the ways on which the wholesome models of "Columbia" and "Constitution" made their first bow to the public, a boat which so far out-Heroded Herod, that her overhangs divide up nearly 60 feet of the overall length of the yacht between them.

At the same time it must be admitted that, with all her exaggerated proportions, the boat bears a strong family likeness to the modern Herreshoff boats; and there is no denying that in drawing out her lines to such extreme length, Herreshoff has produced an extremely handsome craft. As we explained in our previous issue, the hard turn of the midship sections at the bilges is softened out gradually as the forward and after ends of the waterline are reached, with the result that the overhangs themselves are very symmetrical and show a sweetness of modeling which goes far to redeem their disproportionate length. The deckline does not flow toward the bow and stern with so flat a curve as has been customary in earlier Herreshoff boats, with the result that when the yacht is heeled, she will take a very long bearing, and there will be no hard spot or shoulder to pile up the water when the vessel is driven at high speed—as happened in the case of "Shamrock II.," and even more noticeably in "Independence." The great beam of "Reliance," and the fact that her waterline is full, proves that her wetted surface will be very large; and while the small deadrise and long flat floor will give her great initial stability, they will render it somewhat difficult to get her to heel to her sailing lines in light winds. These characteristics combined will render her relatively less speedy in light weather, particularly if there is a troubled cross sea running. But with every added pound in the pressure of the wind, and every added angle of heel, the boat, to our thinking, will show great increase in speed, and even in spite of the excellent work which is being done by "Shamrock III.," on the other side, she should prove to be the fastest 90-footer afloat.

One of the most striking features in the boat is the long drawn-out bow which projects nearly thirty feet beyond the waterline. Only a small proportion of it can be utilized for gaining sailing length; for "Independence" at thirty degrees heel only added five feet of length forward, and she was even flatter than "Reliance." Driving into a head sea, she will take the seas a little earlier but not so much earlier as to compensate, one would think, for the carrying of so much added bow weight at a height of eight or nine feet above the water. Many yachtsmen will wonder why the bow was not made shorter relatively to the stern; for in a low, long stern such as that of "Reliance," every foot of length can be utilized. "Reliance," however, is regarded even by her designer as something of an experiment, and only the actual test in a jump of a sea off Newport or Sandy Hook can determine the value of such an extreme bow.

When the new craft was fairly afloat, it looked as though she might sit a little low in the water when her spars, sails, anchor, crew, etc., which will weigh about 19¼ tons, were put aboard; and although her full waterlines give her great buoyancy, it is not probable that much, if anything, can be gained by a shortened waterline when she comes to be measured.

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Unquestionably the new cup defender is the most interesting 90-foot racing yacht that Herreshoff has built. She is certain to be fast, and under certain conditions extremely fast. Judged on her lines, power, and huge sail plan, she should beat "Shamrock III.;" but the latter boat, up to the hour of her disaster, was certainly doing wonderful work against "Shamrock I.," herself a greatly improved boat.

Where the Mississippi Floods Originate.

Those who look upon the great yellow river that flows past the city of New Orleans, never realize what a vast flood of water and what an enormous assemblage of forces are concentrated in its movement. The area drained by this river and its tributaries equals one-third of the territory of the United States. This area may be divided into the following drainage basins, with their respective areas:

	Sq. miles.
The Missouri River	518,000
The upper Mississippi	169,000
The Ohio River	214,000
The Arkansas and White	189,000
The St. Francis River	10,500
The Red River	97,000
The Yazoo River	13,850
The small tributaries	28,688

This immense area covers some twenty-eight States of the Union, extending from the 35th to the 50th parallel of latitude, and from the 79th to the 114th meridian of longitude. Although the greatest tributaries come in from the West, draining as they do the wide regions extending to the Rocky Mountains, fortunately for the people along this mighty river the rainfall over that region is small; otherwise the Mississippi Valley would be wholly untenable. If the Missouri, which is 3,000 miles long, carried as much water in proportion as does the Ohio, which has a length of only 1,200 miles, the main river would be five times as great as it is.

The Ohio is the chief factor in producing a flood, but alone its waters are comparatively harmless when they get into the main river. When they are supplemented by freshets out of the Arkansas and the Red, however, they become dangerous. The upper Mississippi is only to be feared when its frozen waters break into a thaw earlier than usual. The Missouri waters seldom come before June.

The Current Supplement.

The current SUPPLEMENT, No. 1425, opens with an archæological article on the construction of the Roman camp at Lambessa. The article is well illustrated by two handsome photographs. "New Stereopticon Apparatus" is the title of a description of new projecting devices used in France. M. A. Dastre tells much that is instructive of salt and its physiological uses. The rug industry of the Caucasus and of the Transcaspian countries is described in a picturesque account. By far the most important electrical article in the issue is that by Emile Guarini on the "Development of the Marconi System of Wireless Telegraphy," which article is to be continued through three numbers of the SUPPLEMENT. Each installation will be fully illustrated with diagrams and photographs. Don Maguire presents a vivid picture of the terrors of Death Valley. Alcohol figures prominently these days as a fuel. For that reason two articles, one on the use of alcohol as a fuel and illuminant, the other on the results of tests of alcohol motors in Germany, should not be without interest. A new process for making briquettes is described. M. A. Verneuil's paper on the artificial production of rubies by fusion is published.

Excavation of Prehistoric Bones.

Prof. Warren Morehead, of Phillips Academy, Andover, Mass., has discovered on a farm east of Hopkinsville, Ky., what is presumably the burying ground of a prehistoric people. Ten skeletons in a fair state of preservation were exhumed. The bones are probably those of an extinct race of mound builders. The skeletons were discovered in receptacles built of flat stones. Stone utensils were also found.

A Scottish power scheme of great interest is that which has been recently approved by the British Parliament, and which will soon be under way. It is proposed to generate electricity in the vicinity of the coal mines, and to transmit it to the city of Glasgow and industrial establishments along the Clyde in the neighborhood of that city. Three generating plants will be established, located at Yoker, Motherwell, and Crookston, and the ultimate capacity of this trio will be 25,000 horse power. The two first mentioned will be built at once, but the initial installation will be only about half of the total contemplated.

The Maryland School for the Blind has issued the first general dictionary ever published for the use of the blind. The work comprises 18 volumes, and contains definitions of 40,000 words.

Correspondence.

Bird Catching by a Snake.

To the Editor of the SCIENTIFIC AMERICAN:

Allow me to add a chapter to your late article on snakes. Some thirty years ago a Shoshone Indian told me that a rattlesnake used the rattles on his tail to catch birds. In less than two hours I saw an illustration of it. The snake hides himself in the tall grass and imitates the buzzing of a bee. The insectivorous birds, such as the phœbe and kingbird, are attracted by the sound, and become an easy prey for his snakeship. I have seen rattlesnakes concealed in the dense foliage of trees twenty feet from the ground practising the same deception on the birds and getting the bird every time. G. A. FITCH.

Reading, Cal., March 22, 1903.

Clouds of Pollen Dust in the South.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of this date reference is made to a shower of volcanic dust that fell in the city of Athens, Ga., March 17.

Similar showers fell in this district. It is a common occurrence in all the great pine belts when their pollen is blown about in clouds. I send you samples of this dust as it falls from the flowers, and evidence of its deposit on leaves that floated in ditches.

Closer investigation might identify the Georgia shower as the result of a similar cause.

Biloxi, Miss., April 4, 1903. JAMES BRODIE.

[Our correspondent is undoubtedly correct in his theory. Letters have been received from correspondents in other parts of the South confirming his statement. The dust on the leaves sent by our correspondent closely resembled finely powdered sulphur.—ED.]

Manganese on Manhattan Island.

To the Editor of the SCIENTIFIC AMERICAN:

In the spring of 1901, while noticing some geological conditions on Washington Heights in Manhattan Borough, I found on 146th Street, between Broadway and Amsterdam Avenue, some sharp points of schist, so black as to be noticed even from a distance. At first sight I thought they were smoked by bonfires, but after special attention I found them too many in number and varieties and in impossible locations for such an explanation. On closer examination they were found to be thin weathered incrustations of schist, varying from yellowish-brown to jet black, and they were found not only in that neighborhood, but almost all over the Heights at certain points on fresh-cut surfaces well exposed to the sun.

About two months before this, I had already found at 161st Street and Broadway, a bluish-black mineral which seemed to be psilomelane or wad by the outward look, and had kept specimens in my collection. Thought about this mineral and the black incrustations of the schist suggested to me that I test them chemically by a few drops of hydrochloric acid and potassium iodide and starch test paper. The test proved the mineral and specimens from the black incrustations to be wad or black oxide of manganese. This was a sufficient hint to suggest the existence of silicate of manganese in the schist, which being decomposed must be found deposited as wad somewhere on the island or in the harbor. I followed that, too, and at many fresh cuts found the schist plainly showing the rhodmite ($MnSiO_3$) or tephroite ($MnSiO_4$) while their decomposition could be noticed at different points, according to the length of the time of their exposure, in different shades of bluish-gray or red to brown and black. According to my very limited observation, there are two traces of decomposition of the oxide on the Heights, one at a crevice of the schist between 161st and 162d Streets, on the east side of Broadway, whence a specimen can be seen at the Museum of New York University, and the other in a glacial sandy deposition at 158th Street and Broadway, about six feet below the surface. The main deposition must be sought for elsewhere. It may be under some glacial debris on the island or in the harbor.

Manganese oxide being one of the most valuable minerals of the day, it is well worth the special attention of the city surveyors to locate the main deposition if possible. M. A. YESHILIAN.

New York City.

A Scheme for Pumping Water 380 Miles in Australia.

To the Editor of the SCIENTIFIC AMERICAN:

On Monday, January 19, there was opened at Kalgurli, West Australia, what is claimed to be the longest and biggest pumping scheme in the world. The plant, which is now in full working order, will pump 5,000,000 gallons of water daily, 387 miles, from the Helena reservoir near the sea, to the big terminal reservoir at Bulla Bulling in the heart of the gold fields. To do this there are over 380 miles of 2½-foot pipes, with twenty pumping stations along the route, at which sixty-five big pumping engines are in use.

The work has been made necessary by the great scarcity of water on the famous Kalgurli and Coolgardie gold fields. This district, which is over 400 miles inland, and which embraces such big mines as the "Great Boulder," "Ivanhoe," "Lake View Consols," and "Association"—whose output of gold is measured, not by ounces, but by tons—has a very scanty rainfall, no rivers, and no fresh water lakes. Even the water in the wells is almost always salt or brackish and unfit for general purposes. The residents, therefore, have had only two methods by which to supply their wants—dams to catch the surface water, and condensing plants by which the salt and brackish water was purified. The first of these was unreliable and the second expensive.

In 1895 the then Premier of the State, Sir John Forrest, during a trip, made in very hot weather, to the gold fields, saw plainly that, with the growth of the district, a good and reliable water supply was an absolute necessity. Out of this trip came the present scheme. The great difficulty was the fact that the nearest permanent water was 350 miles away, and that no supply by gravitation was possible owing to the high level of the gold fields. After much surveying and exploratory work a pumping scheme was decided on, and in 1898 tenders were accepted for the work. It speaks well for all concerned that only seven years have elapsed between the conception and completion of the work.

The cost of the scheme will total about £2,850,000, and of course the work of pumping will form a big annual charge. Some 64,000 pipes were used in the work, all being made by Messrs. Mephan Fergusson's (Melbourne) patent locking-bar process, which was illustrated and explained in the SCIENTIFIC AMERICAN some time ago. The manufacture of these pipes used up 9,000 tons of steel plates, and 4,000 tons of Trinidad asphaltum were used for coating them. The pipes are laid in shallow trenches, and owing to the great heat in the summer, trouble was caused at times by leakage, through expansion.

At the supply head, Helena, a splendid reservoir has been formed in a valley, with a huge weir, by which the water is banked back some eight miles. This reservoir impounds 4,600,000,000 gallons, and will be fully equal to all demands for very many years. At each of the pumping stations, reservoirs with a holding capacity of 1,000,000 gallons each have been built, while at Bulla Bulling the main terminal reservoir will hold 12,000,000 gallons. The chief distributing reservoir, at Kalgurli, which is the most important gold fields center, holds 2,000,000 gallons. The towns of Boulder, four miles from Kalgurli, and Coolgardie, a few miles further south, are the other leading centers within the immediate supply area.

Owing to the heavy cost of pumping, the charges are heavy. Interest, sinking fund, maintenance and working expenses will total nearly £300,000 per annum, reckoning on a supply of 2,500,000 gallons daily. To meet this the average charge for water will be six shillings and sixpence per 1,000 gallons. This looks heavy, and would be considered oppressive under ordinary circumstances. But the conditions on the gold fields are far from ordinary, and even with this charge some of the mines calculate that they will save three or four shillings per ton in dealing with their stone. If the maximum supply—5,000,000 gallons daily—be needed, the charge could be reduced to about four shillings per 1,000 gallons. It is believed that, owing to the high price of food, it will even be profitable to use the water for irrigation purposes on a fair area of land. Altogether the scheme is a great one, carried through in the face of much opposition and criticism, and there is a general hope that it will mark the beginning of a new era on the gold fields.

FRANK S. SMITH.

Noorat, Terang, Victoria, Australia.

Test of the Lebaudy Airship.

Dispatches received from Europe state that the Lebaudy airship made two ascents on the morning of April 13. On its first trip the airship covered 19 kilometers, and attained an altitude of 200 meters. On the second trip, made a half hour later, 300 meters altitude was attained, and good progress made against a strong northeast wind. A description of the airship has been published in these columns.

Flooding a Burning Mine With Sea Water.

Sea water is now used to extinguish the burning colliery of the Dominion Coal Company, Nova Scotia. Through a sluice cut from a dam on the shore of the ocean, sea water is pouring in at the rate of some three and a half million gallons an hour. The pit is flooded up to the seventh level, but four more must be reached before the fire can be extinguished. In other words, 450,000,000 gallons of water will be needed, and six days' time required.

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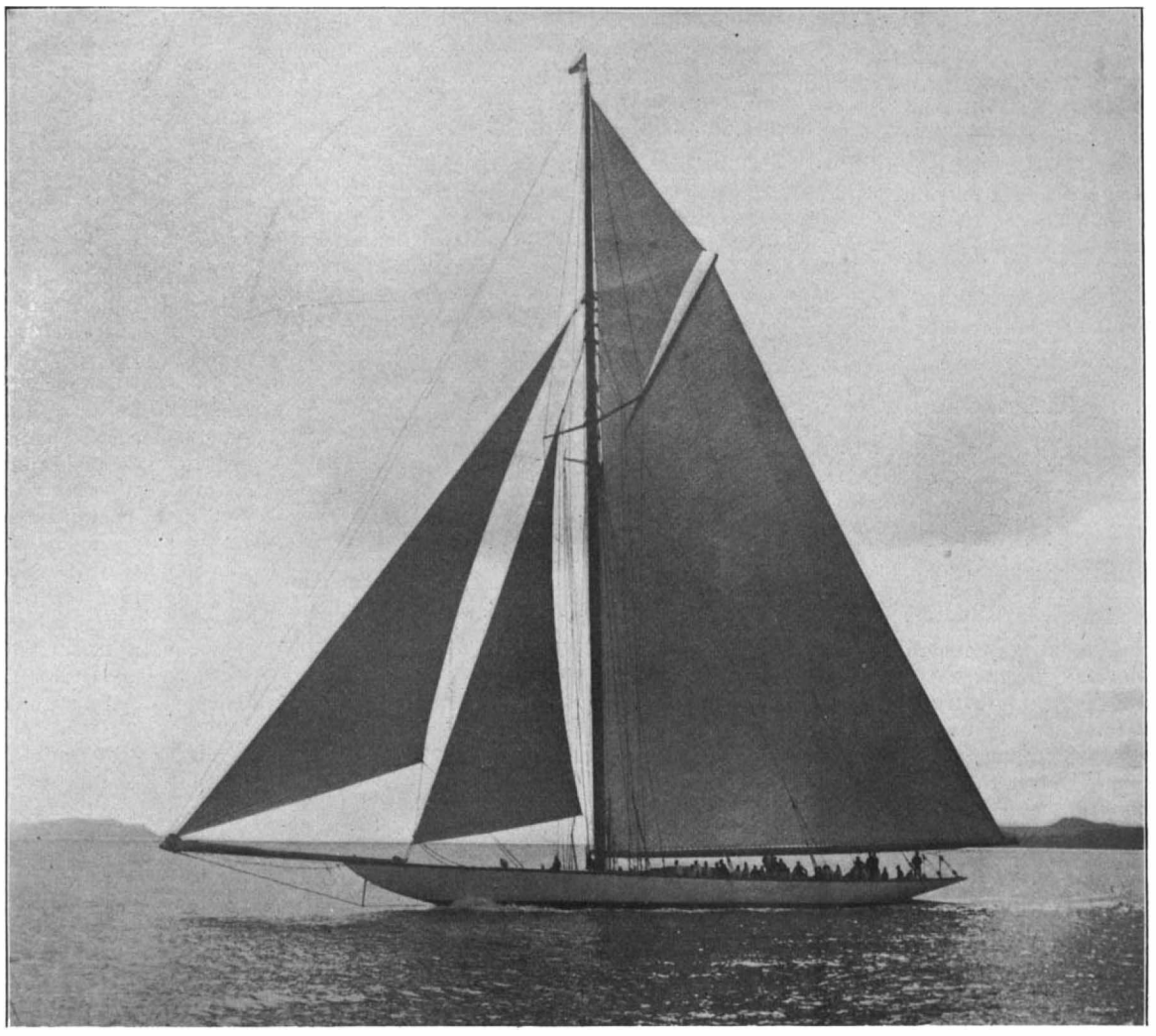
"SHAMROCK III." UNDER SAIL.

From our photograph, which shows "Shamrock III." under sail for the first time after her launch, it will be seen that Fife has given her a lofty and relatively narrow rig. This is apparent, even if we make allowance in the photograph for the fore-shortening of her boom. Experience with the more recent yachts has shown that a narrow and lofty rig gives better results than one that is low and long on the base; for although the center of effort is higher in the lofty rig, and the heeling effect greater, this is more than compensated for by the superior ability of this type in driving a yacht to windward. No doubt it is this feature in the sail plan that has much to do with the fine windward work of the challenger. In the formal races and informal trials in which "Shamrock I." and "Shamrock III." have met, the latter was able not only to point considerably higher than the older boat, but to do so and foot faster through the water at the same time. In running and reaching she is also superior to "Shamrock I.," although not so strikingly so as in windward work. In the earlier trials, indeed, she seemed to be only just about able to hold the older boat in running; but some changes made in her trim appear to have brought out the speed of the boat when running under spinnaker, and she now seems to be consistently faster on this point of sailing. It is in reaching that the older boat is best able to hold the challenger, but "Shamrock I." is conceded to be very fast in reaching. In the first trial race sailed for cash prizes, in which there was a strong inducement for the skippers and crews of both boats to sail their craft for all that was in them, "Shamrock III." won over a triangular course of 34 miles by 6 minutes and 10 seconds actual time. The reports of this race that have reached this side seem to agree that the margin would have been greater, had not a shift of wind assisted the older boat. The best work of the new boat was on the first round, when she gained 2 minutes and 31 seconds on a run of 7 miles down the wind under spinnakers, and on the second leg when she gained 3 minutes 11 seconds in a beat of 7 miles to windward. On another occasion, in a 30-mile course of 15 miles to windward and return the challenger beat "Shamrock I." by 17 minutes and 26 seconds, gaining 10 minutes on the 15-mile run down the wind and 7 minutes on the beat back to the starting point. On another trial of 10 miles to leeward and return the challenger gained about 2½ minutes down the wind, and 6 minutes and 3 seconds during the hour that was consumed in beating back 10 miles to the starting point.

There is no denying that these performances on the part of a comparatively untried boat indicate that the defending American yacht will have a worthy competitor when they meet outside Sandy Hook. Of course their value depends entirely upon the speed of "Shamrock I.," which is claimed by the designer of both boats, and by Capt. Wringe, who formerly sailed "Shamrock I.," to be faster than she was in 1899.

"Shamrock III.," however, has just had the misfortune to be dismasted during a squall, as she was starting on a trial race off Weymouth. The wreck was caused by the parting of one of the weather shroud turnbuckles. This accident unfortunately robs the challenger of the advantage of her early completion, and places her, because of the delay of the sea voyage, one month behind "Reliance" in her opportunities for tuning up.



NEW CHALLENGER, "SHAMROCK III.," RECENTLY DISMASTED IN THE ENGLISH CHANNEL.

"SILOXICON"—A REFRACTORY FURNACE LINING.

BY ORRIN E. DUNLAP.

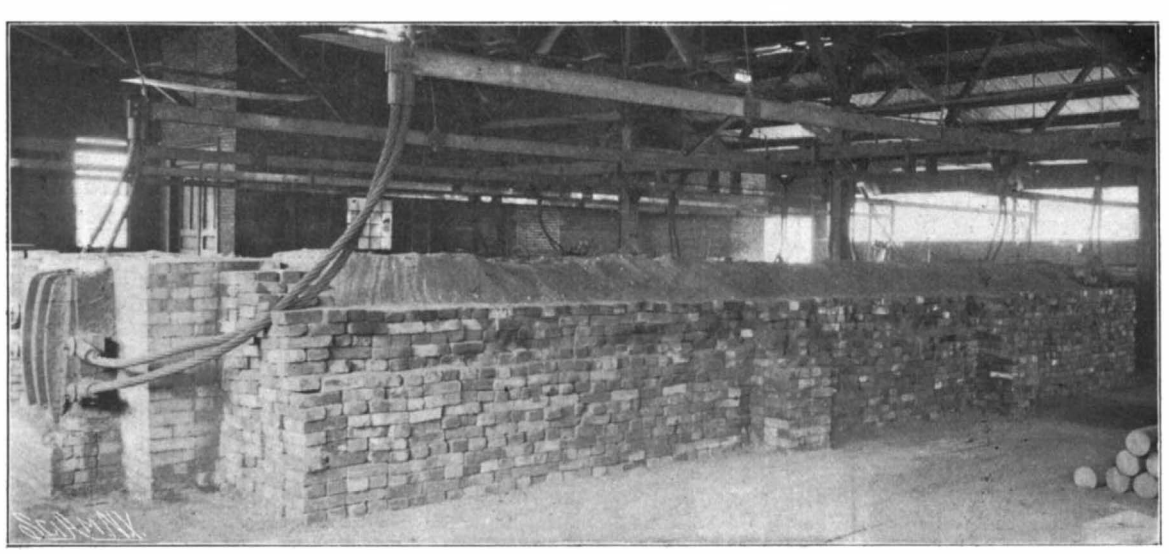
Mr. E. G. Acheson, of Niagara Falls, has invented a process for making a new refractory material which he has seen fit to call "Siloxicon," and which has been referred to in a note published in these columns some time ago. It is an artificially made composition containing silicon, oxygen, and carbon in chemical combination; very refractory under high temperatures, insoluble in metals, inert to both acid and basic slags, and readily shaped into any desired form of lining or article. While siloxicon is self-binding, and the use of a binding agent is not essential in the manufacture of articles, it can be satisfactorily mixed with clay. But alone, in powder form, it can be moistened with water, formed into any desired shape, and fired. It provides a refractory composition suitable for use as a refractory lining for furnaces or converters or as a material for fire bricks, crucibles, muffles, tuyeres, and the like.

Mr. Acheson found that by heating carbon and silica or material containing these substances, compounds containing silicon, oxygen, and carbon in chemical combination are produced which are practical substitutes for refractory clays, magnesia, lime, and graphite in their application to high temperatures. While carbide of silicon, carborundum, is made from carbon and silica mixed together in such proportions that the carbon present will be sufficient to reduce the silica and form a carbide with the freed silicon, Mr. Acheson's latest discovery is that when the amount of carbon is insufficient for the reduction of the silica and conversion of all the contained silicon in carbide, the reduction of the silica is incomplete, and a certain amount of oxygen is retained in chemical combination with the silicon, and compounds containing silicon, oxygen, and carbon are formed.

The first electric furnace for the manufacture of siloxicon has been erected in the plant of the International Acheson Graphite Company, on the lands of the Niagara Falls Power Company, at Niagara Falls. It is about 30 feet long, 8 feet wide, and is built up to a height of about 6 feet. It is larger than a carborundum furnace, but shorter than a graphite furnace. The walls are erected of brick loosely placed without the use of mortar. The raw material used is ground coke and sand to which sawdust may be added to increase the porosity. One thousand electrical horse power is used in the operation of the furnace. It is Mr. Acheson's discovery that the manufacture of siloxicon requires that the temperature of the furnace be kept below that of the formation of carborundum, as at or about that temperature decomposition occurs, the silicon and carbon monoxide escaping from the furnace as vapor and gas, while the carbide of silicon remains in the furnace as carborundum crystals. To make it more clear, it may be stated that siloxicon is formed at a temperature ranging from 4,500 to 5,000 degs. F., carborundum at about 7,000 degs. and graphite at a still higher temperature, estimated.

The carborundum furnace has a single core, while siloxicon is made in a furnace that has multiple cores, which is a feature patented by Mr. Acheson. The raw material is heaped about these cores, and when the furnace is opened the siloxicon appears in a gray-green, loosely coherent mass. It is ground in a mill so as to pass through a No. 40 sieve. In this powdered form it is ready for shipment in barrels to consumers, the present price being about four cents per pound. For many of the articles that will be made of siloxicon it will be mixed with from 10 to 25 per cent of plastic clay. The discovery of siloxicon solves a problem of great importance in metallurgical work. It has been difficult to get a material that will withstand very high temperatures, especially when played upon by fluxing slags. Such a material must be

SILOXICON AS IT COMES FROM THE FURNACE.



SILOXICON FURNACE. LENGTH, 30 FEET; WIDTH, 8 FEET; HEIGHT, 6 FEET. DOUBLE CORES ARE USED.

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insoluble in metals and unoxidizable. Siloxicon possesses all these qualities. At present most metallurgical operations are conducted with high-grade fire clays. These have been improved upon by the use of chrome, silica, and magnesia, but the best of these fall far short of active needs, because of their low melting points or the reaction between the slags. As siloxicon is formed at a temperature of from 4,500 to 5,000 degs. F., it is unaffected by a lower temperature, so that it cannot be touched injuriously by the heat of any flame or fuel combustion. Where oil is used as fuel, siloxicon will be received as a great boon, because it will not melt under the intense heat thus formed.

Crucibles have already been made of siloxicon, and if it proves the marvelous success expected in this field, it will do away with the necessity of going to Ceylon for crystalline graphite. The importance of this is best illustrated by the fact that in 1901 the consumption of Ceylon graphite in the United States amounted to $1,031,289, the greater part of this expenditure being in the steel crucible work.

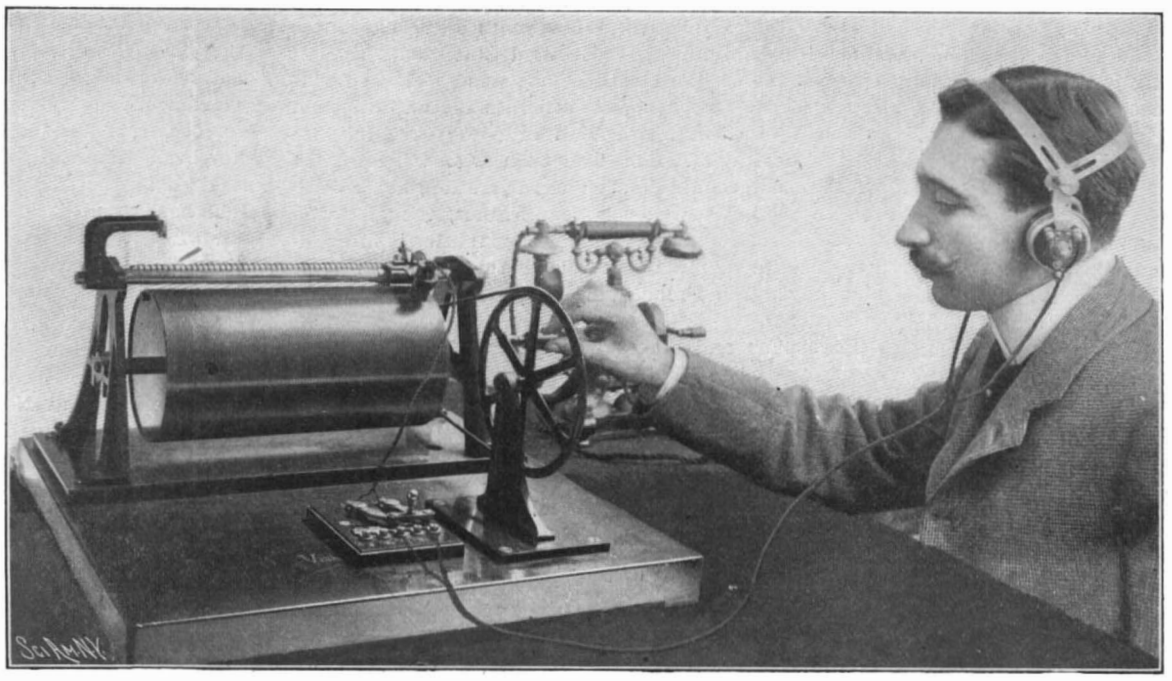
In one of he illustrations the first furnace for the commercial manufacture of siloxicon is shown, while in another illustration is pictured the form of siloxicon as it is taken out of the furnace. To the left in this illustration will be seen two crucibles made out of the new material.

THE TELEGRAPHONE AND THE BRITISH POST OFFICE.

BY HERBERT C. FYFE.

I was privileged the other day to witness the working of an invention which has already been described in these columns and which is likely to prove of immense value to many different classes of the community. The "telegraphone" is a "recording telephone," that is to say, a telephone that records and reproduces messages spoken into it.

The photographs illustrating this article were specially taken when the telegraphone was being exhibited at a recent conversazione of the Institution of Civil Engineers. Thanks to the submarine cable, messages can be sent to and received from all parts of the earth, and the purchaser of a halfpenny evening paper can read of events happening in every quarter of the globe. The telephone cannot as yet rival the telegraph, but each year the distance increases, and telephoning under the sea is now possible across the Channel. While the telephone has done much to facilitate communication in cities and large towns, it cannot be denied that there are many drawbacks connected with its use. Nothing is more annoying to find, after you have succeeded in "getting through" to the person to whom you wish to speak, that the individual in question is "not at home" or "busy." The telegraphone records the message, so that it can be read by the recipient after he has returned or is no longer "busy."



USING THE TELEGRAPHONE AS A PHONOGRAPH.

The advantages of the telegraphone over the telegraph are many. It is much easier to speak than to write, and the telegraphone does your writing for you. The message takes less time to go, there is no chance for mistake, because your words are automatically recorded, and you can make your message so private that it is known only to the person for whom it is intended. The telegraphone, as readers of the SCIENTIFIC AMERICAN know, is the invention of Herr Valdemar Poulsen, a Danish electrician, and was exhibited at the Paris Exhibition of 1900.

Briefly, the Poulsen telegraphone enables a telephonic conversation to be permanently recorded on a steel wire and reproduced at any time.

The manner of working is as follows: A steel wire or a steel band is moved by any suitable means at a considerable velocity between the poles of a small electro-magnet.

The steel wire is wound on a cylindrical drum and receives the record in the form of magnetization induced on it by a small two-pole electro-magnet which is used in place of the telephone receiver of an ordinary telephone circuit. The magnet travels along horizontally, touching the steel wire, while the cylinder revolves as in a phonograph.

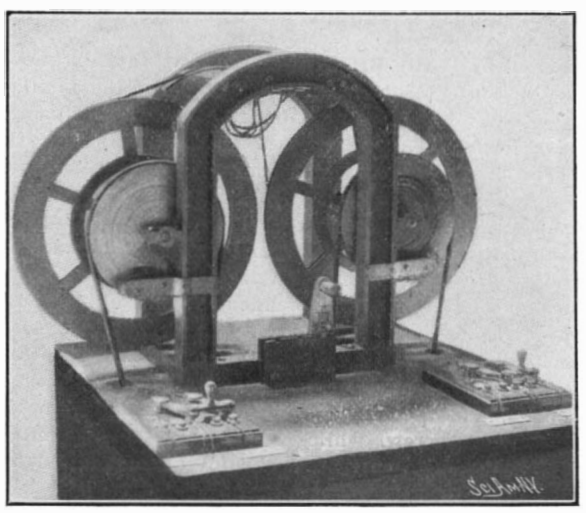
On speaking into a telephone transmitter joined on the circuit at one end of the line, the undulatory currents set up on the transmitter react upon the electro-magnet and cause a continuous variation in the direction and in the degree of magnetism at the poles of the electro-magnet.

These variations are permanently recorded on the steel wire as it rushes by, and when the message is complete, the steel wire retains a definite record of what has taken place in the shape of a continuous series of transverse magnetized lines varying throughout in their polarity and in their strength. On connecting a telephone receiver to the electro-magnet and again starting the steel wire on its course, this magnetized wire generates electric currents in the coils of the superimposed magnet as it passes between its poles, and these electric currents, which are the exact counterpart of those generated by the original wire, cause the telephone to repeat what was said in an almost absolutely perfect manner.

The record can either be permanently kept for future reference or it can be obliterated in such a way that the steel wire can be used for fresh messages. In the latter case the same magnet is again employed, a continuous current being passed around its coils by the microphone battery, whereby turning the wire past the magnet as before, all trace of the record is removed. When very long messages require to be sent, a special "steel ribbon telegraphone" is requisitioned. In this a flat steel ribbon is employed, and run off from one reel to another, across the poles of the electro-magnet. As in the case of a phonograph, the cylinder may be turned by hand, by clockwork or by a motor. The cylinder on which the wire is wound is 140 mm. in diameter, 265 mm. long. On it are 150 turns of steel piano wire, 1 mm. diameter and 1.2 mm. pitch.

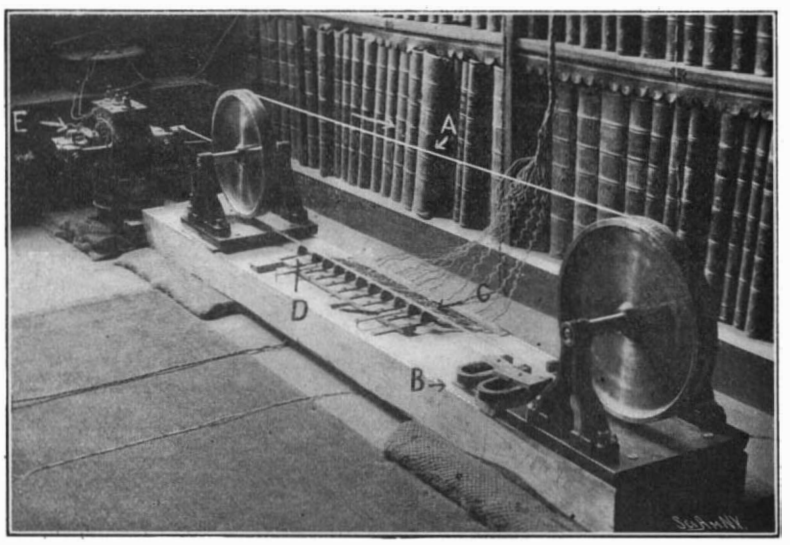
The articulation of the telegraphone is almost perfect and a vast improvement over that of the phonograph. The voice is reproduced quite clearly and free from disturbing noises. Mr. Poulsen says that a message, speech, songs, etc., inscribed on the wire may be reproduced indefinitely without any perceptible diminution in clearness; the tone of the voice remaining perfectly distinct.

Sir William Preece, at a recent meeting of the Institution of Electrical Engineers, said that the greatest novelty in the telegraphic and telephonic line that he had recently seen was the telephone of Mr. Poulsen. It was, he said, a very marvelous thing, and bound to come into use. "It is not only in itself," said Sir William, "beautifully designed and based on beautiful principles, but it is one of those things that is going to open the eyes of all our physicists, scientists, and theoretical men on the question of the molecular character of magnetic and electric operations."



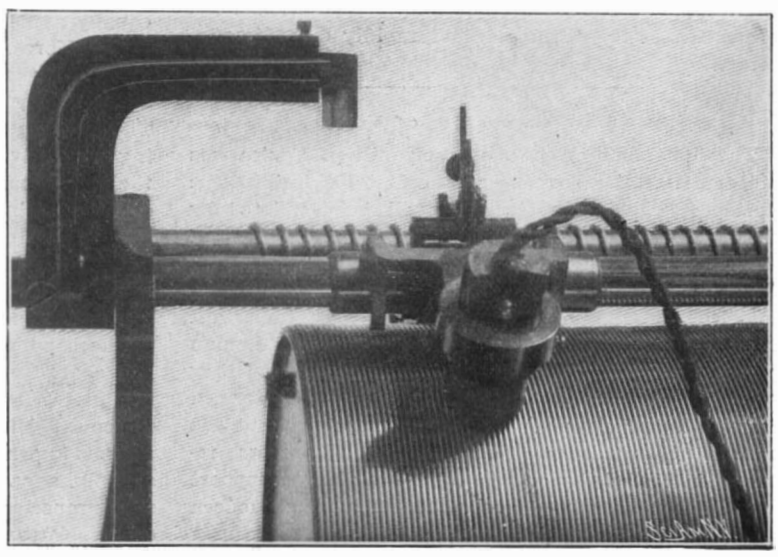
A LARGE TAPE TELEGRAPHONE FOR RECEIVING MANY MESSAGES.

A DESK TELEGRAPHONE.



A, endless steel tape; B, wiping-out magnets; C, recording electro-magnets; D, reproducing magnets; E, electric motor.

RIBBON TELEGRAPHONE EXHIBITED AT THE LONDON INSTITUTE OF CIVIL ENGINEERS.



DETAIL OF THE CARRIAGE AND MAGNETS.

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The man of business who has to leave his office for a time simply places the telegraphone in its place and goes away. When he returns he finds that all the messages that have come for him have been recorded with absolute fidelity on the steel band, and he has only to connect the telephone receiver to the instrument and hold the receiver to his ear to hear the words that have been spoken days or weeks before. Such records will be of great value, for at present confusion and trouble have arisen from the fact that verbal messages or orders have to be relied upon. Besides, it is often very inconvenient to leave one's work or interrupt an interview to attend to the telephone.

In an article which he recently contributed to the Electrician, Mr. Poulsen hinted that it would be possible for the telegraphone to record several messages at once and to reproduce them all separately afterward. At present no details of this arrangement have been made public.

Besides its use as a recording telephone, there is another and even more important use for the telegraphone, and this is as a telephone repeater or relay. Relays are used in long-distance telegraphic cables because the currents are not strong enough to work the receiver directly, and have to be passed through a series of relays in order that they may do their work. For the past twelve years the electrical world has been seeking for a satisfactory telephone relay, such as would make speech between London and New York and other distant places possible, but so far the problem has not been solved.

A telephone repeater would of course increase the range of telephonic speech and decrease the cost of long lines, and it may be mentioned that the president of one of the American telephone companies some time ago offered publicly a reward of $1,000,000 for a thoroughly satisfactory telephone repeater, but no one has yet earned the money.

In conjunction with Mr. E. S. Hagemann, Mr. Poulsen has endeavored to adapt his invention to act as a telephone relay, and we believe that excellent results have been obtained.

Yet another use for the telegraphone is for the multiple transmission of the same sound, whether it be a speech, message, musical performance, etc. This is of course at present accomplished by the ordinary electrophone or theatrophone, but if the telegraphone be substituted, the transmission can be extended to a far greater number of lines, as an indefinite number of telephone receivers may be connected to the telegraphone.

It is Mr. Poulsen's idea to start a "telephone journal," by means of which news will be transmitted by telephone to numbers of subscribers.

The Navy League of the United States.

There has recently been organized in the United States a Navy League, whose object is to secure a navy commensurate with the country's requirements. To this end it proposes to draw public attention to our naval standing relatively to the navies of the world, and to create a public opinion on the question of naval increase that will react favorably upon Congress when it comes to legislate on naval affairs. Leagues of this kind already exist in England, France, Germany, and Italy, and in every case they are non-partisan and possess no political significance whatever. As an instance of the work done by similar organizations in other countries, we may take the case of Germany, where the impetus given during the past few years to naval affairs is attributed largely to the influence of the Naval League, in which the German Emperor himself is an indefatigable worker. The German League has gone into the matter with the thoroughness that characterizes the German people in dealing with matters of national importance. The aims of the new League are highly commendable, and we trust that it will be successful in assisting forward the good work of providing this country with a navy adequate for the protection of its worldwide and rapidly extending interests.

The New Campanile of Venice.

The first stone of the new campanile of Venice was laid April 24. By next spring the first 100 feet will be finished. The entire structure will be completed by the spring of 1906. Examination of the remains of the fallen tower proved that the bricks had been used for various purposes at a previous stage, in arches, fortifications, tops of walls, etc. The most important fact was that they were not Venetian, but Roman bricks. Moreover, when they were manufactured they were not manipulated like modern bricks, but formed from slices of clay; for they were found without the natural layers being disturbed. This process resulted in each individual brick being able to support a weight quite four times as great as the modern brick. It is pointed out that the new Campanile may be built to-day of bricks of the same origin. The bricks examined are of the first century. One bore the impression of a horseshoe, proving the debated point that horseshoes were then in use.

THE KOREAN TWINS.

The appearance in this country of the Korean twins, as they are termed, has caused them to be the subject of considerable study among scientists who were familiar with the Siamese twins, who attracted such attention when first exhibited in the United States. Comparisons have also been drawn between the Koreans and the female twins upon whom the operation was performed in Paris a few years ago. The latter were also exhibited in the United States, but, as will be remembered, the health of one was so affected that it was deemed necessary to separate the natural band which held them together in order to save the life of the healthier child. The twin who was afflicted with consumption died after the operation, but according to the latest reports from France, the girl who lived has entirely recovered, and apparently is in excellent health. It may be added that she has been adopted by the French surgeon who officiated at the operation.

Physicians and others who have examined the Koreans are of the opinion that they bid fair to live much longer than the Siamese, as they are active and vigorous, and thus far have had no ailment of consequence. Liao-Toun-Chen and Liao-Sien-Ne-Chen, as will be noted by the accompanying photograph, have typical Oriental features and might be taken for Chinese, but they were born in Korea. They are a little over twelve years old and well developed for their age, having no notable physical imperfection except the

THE KOREAN TWINS.

band which connects them. As in the case of the girl twins, each has all of the usual organs, and it is the opinion of eminent surgeons that they could be separated if desired with little danger of fatality. Liao-Toun-Chen is slightly taller than his brother and somewhat better developed, being more muscular. An examination shows that his heart beats much more rapidly, while his respiratory capacity is somewhat greater than that of the other. The smaller twin is left-handed, although from his position he is obliged to use both hands to such an extent that he is practically ambidextrous. He is more susceptible to changes in temperature, and apparently feels pain more than his brother, but in appearance seems to be equally as healthy.

The Koreans apparently have much more freedom of motion than the other types referred to. They can stand nearly side by side, face each other squarely. The freedom with which they can move without injuring themselves allows them to be quite active, and their motions are so harmonious that they not only walk, but run, and play various games without difficulty. One feat which the Siamese were unable to do was that of facing each other, one twin resting his hands on the shoulders of the other. The Koreans can easily assume this attitude, owing to the elasticity of the band which unites them. It is of a membraneous character, and measures about 3½ inches in diameter. When not stretched or pressed in any way, it is about 8½ inches in circumference. When the twins are moving in any way, the band swells and diminishes slightly, apparently being connected with the principal trunk muscles of the bodies.

The Koreans, who were brought to this country by the Barnum & Bailey Company, have shown quite remarkable intelligence. When they first came to the United States with their father, they remained in Bridgeport, Conn., and were provided with an instructor, from whom they acquired the rudiments of the English language. Then they took up a number of the primary studies, and have advanced quite rapidly.

Brief Notes Concerning Patents.

We have all heard of the wonderful Chicago slaughtering houses, where, according to one story, a live pig is taken in at one end of a machine and turned out at the other in the form of sausages and collar studs, everything being used except the squeal. Now comes the news of another prodigious example of mechanical ingenuity. A Swedish inventor, it is said, has constructed a machine which takes herrings as they come from the net, sorts them into the four sizes required by the trade, scrapes off their scales, cuts off their heads, splits, cleans, and washes them inside and out. Twenty thousand herrings are thus turned out every hour. The story is probably to be taken with the proverbial grain of salt.

Sylvester Babcock, of Buffalo, who claims to have been responsible for the first twist-barrel rifle, is living in that city. He occupies an old hut in the rear of an ice house at No. 26 Metcalf Street. He is almost blind, and unable to do any work whatever. He still has the original plans and specifications on which the original patent was granted twenty-five years ago, and says that after the first gun was finished and submitted to the Ordnance Department of the government, he received $5,000 with which to pursue his work in this direction, and this, he says, is all the money he received from the invention. He says, however, that the persons who were associated with him in the venture grew rich from his idea.

A bottle-blowing machine, which is said to be suitable for a very great variety of work, has been recently invented by M. J. Owens, the patent expert of the Toledo Glass Works at Toledo, Ohio. That gentleman has been a great many years experimenting in this direction, and is responsible for a lamp-chimney blowing machine which is said to have already revolutionized that line of work. A great deal of time and money have been expended in the direction of securing a bottle-blowing machine, and the nearest approach to the desired object has been the machine by which the wide mouth fruit jars have been made. While this has been very successful, a satisfactory bottle blower has not been made up to the present time. The design of Mr. Owens has been in practical operation for some time at the plant on Detroit Avenue near Monroe Street, Toledo, and has demonstrated its usefulness fully. A number of them are accordingly being made, and will be made use of at this same plant.

An ingenious kite for utilization in connection with life saving at sea, in case of shipwrecks, etc., has been devised by Comte Brossard de Corbigny, and is known as the Cerf-Volant B. C. The kite is of the familiar type, and it is claimed by the inventor and others who have examined and inspected the contrivance at the Paris office of the Société Centrale de Sauvetage des Naufrages, that it is more serviceable aboard ship than any other life-saving device. When a ship runs ashore the kite is released, and the wind blowing on shore carries it inland, and when it is over the desired spot, an ingenious maneuver brings the guide rope within reach of those on the shore, thus establishing communication between the wrecked ship and the land. A pocket in the kite contains a series of signals, and accommodation for a message from the shipwrecked crew, while a receiver and transmitter for the establishing of telephonic communication are also attached. The invention has been tried with satisfactory results at Toulon and Brest, and an effort is being made to secure its adoption by the various shipping companies throughout the world.

The members of the Canadian Cattle Guard Commission, which has already been referred to in these columns, is composed of Messrs F. I. Holt, C. E., and George Robertson, with headquarters at Ottawa. Efforts are being made to secure specimens of cattle guards of all kinds for these tests, but none will be considered unless it is sent to the commission in such a shape that it can be put to a practical trial. A section of a standard gage track has been laid at the Ottawa Fair Grounds, with the usual number of ties and fully ballasted. The passageway is 17 feet wide, and in this the guards to be tested are placed, closing the whole 17-foot space either with the guard or the side fences. A couple of herds of cattle are kept on hand for this purpose, and when it is desired to put one of the devices to trial, a bunch of cattle is turned in the building from one end, and at the other end is a tempting haystack, which the animals soon discover, but their passage to this is cut off by the guard. There are a number of conditions which contestants must observe, and it is announced that what is sought for most is a device which will turn the cattle back. Trap-like constructions which hold the animals will not be considered.

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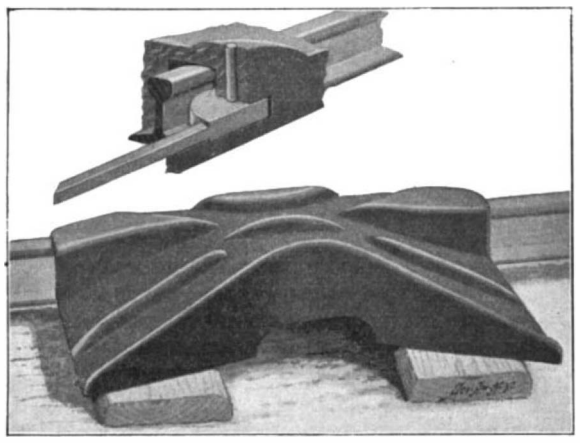
Patent Department

CAR REPLACER.

The accompanying engraving illustrates a car replacer which, while comparatively light, has nevertheless a strong construction and furthermore embodies convenient means for securing it to a rail. Mr. John H. Fowler, of Somerset, Ky., who is the inventor of this simple device, has had practical experience in railway

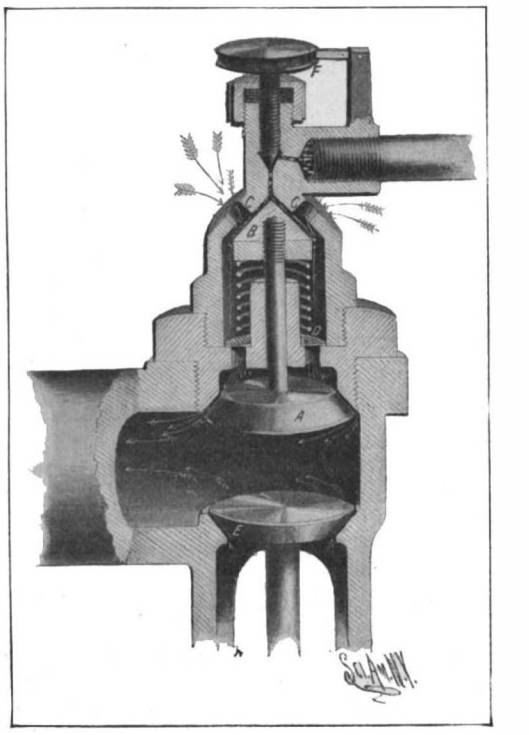


CAR REPLACER.

matters and has made careful study of the business of replacing derailed locomotives and cars. The replacer comprises a platform which is sloped downward from its center in both directions, forming inclined planes which will lead the wheels up to their proper positions on the track. At the outer side the platform is provided with a rib which is curved inward or toward the rail. At the opposite side is a box-like portion adapted to fit over the rail. A locking lever is hinged to the outer wall of the box portion. This lever is provided with an eccentric head for tightly clamping against the rail web. The inclined planes are divided by ribs which guide the car or locomotive wheels in toward the rails. At the top of the incline is a deflecting block. This directs the wheel flange through a groove in the box-like portion to the inner side of the rail, while the wheel is guided to the tread of the rail. The replacer may obviously be placed on either side of the rail and may be made of any desired length or of any desired width so as to replace a wheel from different distances from the rails. The device is preferably made of stamped steel and can thus be made very light and yet have the requisite strength.

MIXING VALVE FOR EXPLOSION-ENGINES.

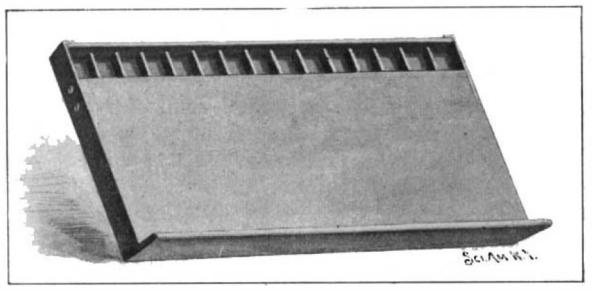
Mr. Maurice Pivert, of 1714 Saratoga Street, New Orleans, La., is the inventor of an improved form of mixing valve for explosion-engines of the four-cycle type. The valve provides a perfect mixture of the air and the gasoline vapor, insuring a powerful and regular explosion of the mixture in the working chamber of the engine. A vertical section of this valve is shown in the accompanying illustration, and its operation is as follows: When the piston in the cylinder of the engine is on the suction-stroke, the valve *A* opens inwardly, drawing down the valve *B* against the tension of a spring. This permits gasoline to pass through a supply pipe into the chamber *D*. On account of the conical shape of the valve *B* the gasoline which is admitted at the apex spreads and flows downward evenly over the sides of the cone. At the same time air is sucked in through the openings *C* and coming immediately in contact with the gasoline is thoroughly mixed therewith. This mixture passes down through a screen in the bottom of the valve chamber *D* and thence passes out into the working chamber and cylinder of the engine, as indicated by the arrows. On the return or compression stroke of the piston the explosive mixture in the cylinder is compressed and finally ignited to send the piston down on the power stroke, and when the piston returns the valve *E* is opened to cause exhaust of the products of combustion from the working chamber to the exhaust chamber. On the next downward stroke of the piston the suction period sets in and the above-described operation is then repeated. When the piston reaches the end of the suction stroke the valves *A* and *B* move immediately to their seats by the action of the coil spring and remain closed until the next suction period sets in. The flow of gasoline into the mixing chamber is regulated by the feed valve *F* which is held against accidental movement by a spring entering notches in the head of the valve.



MIXING VALVE FOR EXPLOSION-ENGINES.

TRANSFERABLE JOB BANK.

A simple form of bank for use of job printers is shown in the accompanying illustration. It consists of a flat, longitudinal slab provided with a rib at its lower end, after the manner of an ordinary type-case. At the upper end is a longitudinal groove divided transversely by means of thin reglets into compartments or boxes. It will be observed that the compartments thus formed are sunken flush with the surface of the slab. This constitutes a great advantage in the invention; for job printers dislike to be annoyed by a multitude of loose receptacles resting upon the surface of the object at which they are at work. In use the bank being placed upon the rack or upon the lower case, as desired, a job galley is laid upon the slab with its lower edge resting against the rib. The printer now places the job form upon the slab and proceeds to apply his leads, slugs, furniture, ornaments, etc., in

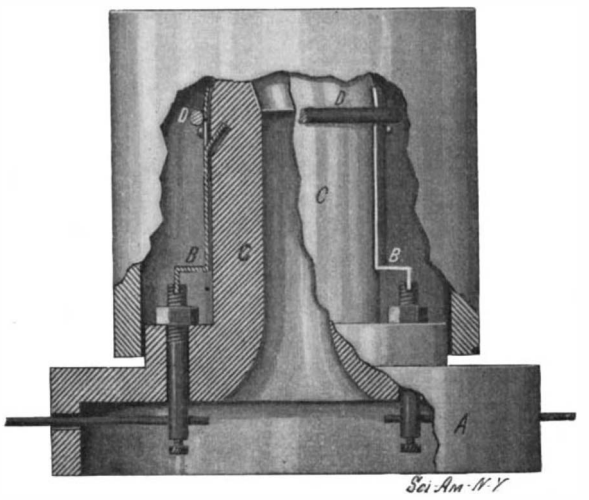


TRANSFERABLE JOB BANK.

the usual manner. The countersunk compartments are used for containing spaces, quads, dashes, ornaments, and such other standard articles as are constantly needed in job printer's work. The contents of the compartments may be changed from time to time according to the nature of the work. As the job-bank may have substantially the proportions of a type-case, and being transferable, it can of course be substituted for a lower case, or it can be used in connection with an upper case for containing materials not used quite so frequently. The many uses to which the boxes can be put will be readily apparent to all printers and these, coupled with the extreme simplicity and cheapness of the device, render the invention particularly valuable. The inventor of this improved job bank is Mr. Guy M. Green, 866 21st Street, Oakland, Cal.

FUSE PLUG.

We illustrate herewith an improved form of fuse plug for electric circuits invented by Mr. Sidney Rothschild, of 205 West 116th Street, New York, N. Y. The device can be very cheaply made and may be easily repaired in case the plug burns out. The parts are arranged so as to insure a secure connection between the ends of the circuit wires to be joined. The casing *A* of the fuse plug is made of porcelain or other suitable non-conducting material, and is formed at the bottom with a depending flange. The conducting wire terminals extend through the flange from opposite sides and are secured inside the casing to bolts held loosely in openings in the casing. These bolts are slotted at their upper ends to receive the contact plates *B*. The plates are preferably made of spring metal and extend on opposite sides of the post *C* projecting vertically from the casing. V-shaped tongues are struck up from these plates and enter recesses in the post, the arrangement being such that when the nuts on the bolts are screwed down the tongues will be pressed up into firm engagement with the walls of the recesses, thus securely holding the plates. The electric circuit is completed between the plates by a fuse in the shape of a ring *D* of lead or other metal having a low melting point. This ring may be kept from slipping down too far on the plates by lugs projecting therefrom. The cover of the fuse plug is made of porcelain and has the shape of an inverted cup with a central lug which fits into a corresponding recess in the upper end of the post *C*, thus holding the cover in proper position to securely encase the fuse ring. In

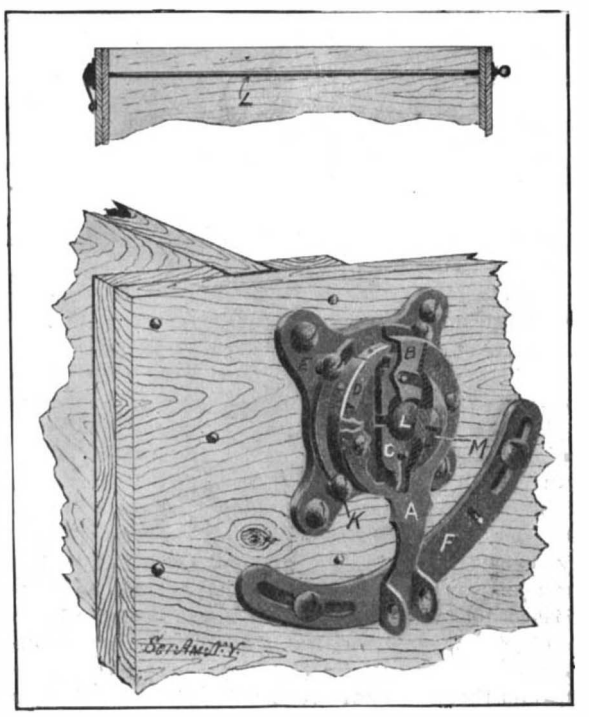


IMPROVED FORM OF FUSE PLUG.

case the fuse ring burns out, it is only necessary to remove the cover and slip a new ring over the contact plates.

SIDEBOARD-ROD FASTENING.

The sideboard-rod of a wagon, it will be recalled, is the rod which braces the sides of the wagon body against the endboard. This rod, which must be removed to permit free access to the rear of the wagon, is usually secured by a nut, which can be operated only by the use of a wrench. Mr. S. S. Bolton, of Scottville, Mich., has invented a new form of fastening which is illustrated herewith. By simply swinging the finger-piece *A*, this rod may be instantly released or secured. The device, though it may at first sight appear rather complicated, is, nevertheless, quite simple, and we are assured can be very cheaply made. The finger-piece, it will be observed, projects from a cap which covers, and is fastened to, the cup-piece *B*. The heads of the screws *K* overlap the base flange of this cup-piece and secure it to the base-plate *E* without preventing it from rotary movement with the cap and finger-piece *A*. Within the cup *B* are two grippers *C* having pins thereon which project through slots in the face of the cup. These slots are so shaped that on movement of the finger-piece to the left, the grippers will close on to the projecting end of the side-board-rod *L*. This is further assisted by the cams *D*, secured to the sides of the cup and acting on the outer ends of the grippers. The end of the rod *L* is threaded and fits a corresponding thread in the grippers. The grippers are held in the locked position illustrated by a lug on the finger-piece *A*, which snaps into a socket in the quadrant *F*; a similar socket is provided at the right for holding the parts in the open position. It will be observed that the quadrant is provided with slots at each end, through which the fastening screws are passed. This permits adjustment of the quadrant, whereby the position of the locking socket may be accurately fixed. At the center of the cap *A* is an opening through which the rod *L* may project if too long; otherwise this opening is closed by a screw *N*.



SIDEBOARD-ROD FASTENING.

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Legal Notes.

Invention and Mechanical Skill in Adaptation.—No doubt it is not every slight advance in an art, such as is constantly being made by mere mechanical skill and adaptation, that is to be considered invention. It is at the same time recognized that the impalpable something which is said to distinguish invention from simple mechanical skill is not easy to discriminate and define, and in the attempt to judge it after long lapse of years the courts are in danger of being misled by the increased intermediate knowledge. One criterion of invention is that others have sought and failed, even where the process is so simple, when discovered, that many believe they could have produced it, if required.

These circumstances were all deeply considered by the Circuit Court in deciding the recent case of Hanifen vs. Armitage (117 Fed. Rep. 845). That case was a suit for infringement of letters patent for a knitted fabric issued to Levi Bywater on December 13, 1887. The patent has been the subject of marked vicissitude. It was first sustained by Judge Dallas in Hanifen vs. E. H. Godschalk Company (C. C. 78 Fed. 811), but upon a rehearing, on account of certain expert evidence, by which he felt himself controlled, he decided against it. On appeal, however, he was reversed, and the patent upheld, although the Court of Appeals was not unanimous, Judge Butler dissenting from the views of Judge Shiras and Judge Acheson, who constituted the majority (28 C. C. A. 507, 84 Fed. 649). The patent came up again before Judge Gray in Hanifen vs. Lupton (C. C. 95 Fed. 465) where its validity was conceded, the suit being defended on other grounds. Next the patent appeared in the second circuit, and was sustained by Judge Townsend in a well-considered opinion (Hanifen v. Price, C. C. 96 Fed. 435); but he in turn was reversed by the Court of Appeals of that circuit in an opinion by Judge Shipman, and the patent declared invalid (42 C. C. A. 484, 102 Fed. 509). On account of these conflicting decisions in the two circuits, the Supreme Court allowed a certiorari in the latter case, and it was supposed that the matter would be thus put at rest. But again there was a serious difference of views, which resulted in an affirmance by an equally divided court. Such an affirmation establishes no precedent or principle, for a particular circuit.

The patent was issued in 1887 to Levi Bywater, and, according to the second claim which is the one in controversy, the invention is declared to be "a knitted fabric, composed of face and back yarns of different materials, the face yarn being looped at regular intervals and on alternate stitches of adjacent rows of the back yarn, and being matted and curly, and having a smooth back, whereby the said fabric has the appearance of looped or Astrakhan cloth as described."

In the specifications which precede, the invention is said to consist of "a new and improved textile fabric having the face yarn thereof looped on the stitches of the back yarn; . . . the said face, which is formed of mohair, worsted, or other yarn, being beat up so as to present a wavy or curly surface, and the back, which is formed of woolen or other yarn brushed so as to present a smooth surface, the fabric having the appearance of looped or Astrakhan cloth." In carrying out his invention the patentee declares that he employs a circular knitting machine, a partial description of which he gives. In the operation of knitting the fabric he says that the thread by which the rough face or Astrakhan effect is produced is so placed upon the needles by the backing-wheels as to be alternately in front of and behind two needles, the backing-wheels being so set in a four-feeder machine that for successive rows of the fabric they alternately press back different needles, thus forming the loops on alternate stitches of adjacent rows. It will be thus seen that the patent is distinctly for a textile fabric of specific character and designated structure. It is not for the process by which it is made, nor the machine for making it, each of which is referred to merely to aid in describing it. The question, therefore, on which the validity of the patent depended was whether the fabric was new, or had been previously, in whole or in part, anticipated. On this question it was brought into comparison with the prior British patent of James Booth in 1881. There were other references, but, without stopping to discuss them, the case seemed to turn on this one. Unquestionably imitation Astrakhan existed before either of these inventions; but it was the woven, and not the knitted article, which Bywater was the first actually to produce. As said by Judge Dallas in his first opinion: "Knitted Astrakhan was created by Bywater, and this he accomplished not by merely applying the skill of the knitter to effect a change in either of their (i. e. prior) products, but by the exercise of his own inventive faculty." That is the whole case in a nutshell, and it is abundantly sustained by a proper consideration of the matters involved. Booth did not aim to knit Astrakhan, and his patented invention, unaided, was not calculated to do so. What he claimed to have invented was simply a novel description of looped fabric of ornamental appearance, whatever that might mean.

Bywater, by a wise choice of yarns and continued mechanical improvement, succeeded in presenting to the public an attractive fabric, and had the great merit of being patient in the work of mechanical development, but the inventive idea was absent.

No knitter had produced Astrakhan cloth before Bywater. How then, the court asks, can it be inferred that any skilled knitter could? He could if he had the inventive genius to conceive it as Bywater did, but he could not without it.

It is the structure rather than the appearance which determines infringement, or rather the appearance and the structure combined, the latter being the controlling feature. Turning to the patent and analyzing each term, the court found that the looping of the face yarn "must be at regular intervals and on alternate stretches of adjacent rows of the back yarn." Admittedly these terms are not technical and are to be construed according to their ordinary meaning, in which the opinions of experts are of little aid.

Construing the second claim the court found that the defendant's fabric clearly infringed upon it in the main. A decree was drawn holding the patent valid and referring the case to a master to take an account.

A Chromo-Lithograph Copyright Decision by the Supreme Court.—In the case of Bleisten against the Donaldson Lithograph Company, the Supreme Court of the United States decided that three chromo-lithographs, designed by employes of Bleisten to advertise "The Great Wallace Shows," were entitled to protection of the copyright law, and that Bleisten was entitled to an injunction restraining the Donaldson Company from reproducing them. This was a reversal of the judgment of the Sixth Circuit Court and of the Circuit Court of Appeals. Justice Holmes delivered the opinion of the Court. In construing that section of the Revised Statutes which allows a copyright, the Court held that chromo-lithographs are pictorial illustrations. The word "illustrations" does not mean that the pictures must illustrate the text of a book, and that the etchings of Rembrandt or Steinlas' engraving of Madonna di San Sisto could not be protected to-day if any man were able to produce them. And yet that does not mean that ordinary posters are not good enough to be considered within its scope. The antithesis to "illustrations of works connected with the fine arts" is not works of little merit or of humble degree or illustrations addressed to the less educated classes; it is 'prints or labels designed to be used for any other articles of manufacture.' "

Certainly, works are not any the less connected with the fine arts because their pictorial quality attracts the crowd and therefore gives them a real use—if use means to increase trade and to help to make money. A picture is none the less a picture and none the less a subject of copyright that it is used for an advertisement. And if pictures may be used to advertise soap, or the theater, or monthly magazines, as they are, they may be used to advertise a circus.

The Court was of the opinion that the plaintiff had rights entitling him to the protection of the law. Justice Harlan delivered a dissenting opinion, in which he said that mere advertisements were not such works of art as were contemplated by the copyright law.

Effect of Exhibition of a Painting Without Notice of Copyright.—In the case of Werckmeister v. American Lithographic Company et al (117 Fed. Rep., 360), an artist transferred to complainant the copyright in his picture, and complainant caused the picture to be copyrighted in this country. Furthermore, the complainant published copies, all of which bore notice of copyright as required by the statute. After the transfer, the picture was publicly displayed at the exposition of the Royal Academy of Arts at London, for several months, without notice of the copyright. Thereafter, the defendants published copies of the picture. The complainant sought to restrain further publication.

Assuming that the artist, by the transfer, authorized the complainant to procure the copyright, then, the court said, it would follow that the complainant had the right to do precisely what the artist himself could have done, and that his rights were subject to the same burdens. The author and proprietor of a painting cannot enable another to take the copyright, reserving to himself the painting, and therefore releasing the assignee from a statutory duty. The statute commands that the subject of the copyright—here the painting—shall, if displayed, bear the notice.

The complainant could not arrange to procure the copyright in his own behalf, leaving the painting with the artist and proprietor, and rid himself of the responsibility which the statute places upon the owner of the copyright, viz., that the painting, if publicly displayed, shall bear the requisite notice. The rights and obligations of the complainant are those conferred and imposed by the statute upon the author, designer or proprietor. It is true, that the artist, by displaying the picture has wronged the complainant; but he has also misled the public, and has been able to do this by the failure of the complainant to see to it that the duty imposed by the statute was fulfilled. In short, the statute gives to the assignee what it gives to the assignor, and no more, and all conditions subsequent that would operate against the assignor are equally effective against the assignee. The duty demanded by the statute has not been performed, and it is to be presumed that in consequence of such non-fulfillment, the persons intended by the statute to be warned that the painting was copyrighted, have not been so advised, and have acted accordingly. The motion for a preliminary injunction was denied.

The Wernicke "Elastic" Book Case Patent Invalid.—The Globe Wernicke Company brought an action against the Fred Macey Company for infringement of letters patent granted to Wernicke for sectional bookcases. The bill was discussed by the Circuit Court, and an appeal taken to the Circuit Court of Appeals (119 Fed. Rep. 696). In his patent application, Wernicke stated that his invention was a sectional bookcase of such construction that each section may be collapsed and shipped in a knockdown condition, and afterward readily assembled by the person to whom it is sold. A particular construction of the door, back, and other parts of a section and the combination of these parts was also described and claimed. The general plan of his bookcases consists in building cases for each row of books intended to be accommodated, separately, in the form of a long box opening at the front by a glass door hinged by a hook under the top of the case on a pin projecting in from the body of the case at each end, and normally hanging down and closing the case, but adapted to be turned outward and upward from the bottom and pushed back over the pivots through grooves on the inside of the case, to accommodate the removal and replacing of the books standing in the case. These doors have a strip of felt fastened to the inner edge of the top rail to close the opening and keep out the dust and air. The cases are of equal length and otherwise of such conformity that they may be piled one above the other, and the tiers placed end to end, and having interlocking dovetailed attachments at their ends, and having also two strips lengthwise on the bottom, and a corresponding single strip lengthwise of the top, adapted to fit between the two bottom strips of the next section above, by which they are secured together and made to present an even front. They could be piled as high or extended lengthwise to such an extent as is desired. Metallic strips are fastened around the ends and front corners of the case at the bottom, extending downward so as to shut down outside of the top of the case below, on which strips the interlocking attachments above mentioned are fastened. Suitable bases and caps are provided, but they constitute no part of the invention.

After an examination of prior patents the court was satisfied that it was a well-known method of attaching and using a door to hinge it at the top by an ear or other form of pivot over which the door was raised and pushed back, sometimes in guides on the inside of the case, and sometimes with the pin or grooves on the opposite members. Such devices have been employed, and so far as the court could see the form of hinge employed by Wernicke was old. After a full and careful consideration of the patent on which the complainant relied, the court felt constrained to reach the conclusion that it exhibited nothing more than a judicious selection of well-known devices, obvious in their purposes and putting them into the construction of bookcases and that there was nothing of the quality of invention in any part thereof. Given the idea of sectional bookcases the imposition of one upon another and the lateral extension of these bookcases by duplication of the tiers, all the expedients employed in carrying out that idea were borrowed and not invented. In the Court's opinion the things borrowed were close at hand and had already been discussed. The opinion of the Circuit Court was affirmed and claims 12, 15, 16, 17, 18, 19, and 20 were held to be void for lack of invention.

To sustain a patent for a new use of an old process, there must be some change in the manner of application or some result substantially distinct in its nature. If the new use is so nearly analogous to the former ones that the applicability of the device would occur to a person of ordinary mechanical skill, it is only a case of double use, and no invention is shown.

While a patent for a combination is not infringed if any one of the elements of the combination is omitted, a change in the form or the location or sequence of the elements will not avoid infringement, where they are all employed to perform the same functions, unless form, location, or sequence is essential to the result or to the novelty of the claim.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

PITCHING APPARATUS.—S. C. SPANGLER, Clyde, Oklahoma Ter. This apparatus is designed for handling grain, hay, and the like, and is adapted for use in feeding sheaves of grain to a thresher. At the base of the machine the operator manipulates the various parts to move the grain and other material from its resting-place and "pitch" it into the thresher. It is under complete control, owing to the various cables and other gear provided.

PLOW-POINT.—G. N. MOODY, Afton, La. The invention refers to plow-points generally and specifically to a combined detachable plow-point and share-cutting edge formed in one piece in improved conformation, whereby it may readily be detached for renewal. Owing to special means for its attachment a more secure fastening is afforded.

Electrical Devices.

TELEPHONE CALL SYSTEM.—E. A. TERPENING, Geneseo, Ill. This system admits of general use, and is particularly adapted to party telephone lines employing either bridge or series circuits. High resistance magnets prevent the calling apparatus from closing the main talking-circuit, and the generator-coils are so wound as to generate a current of great strength so that one-twentieth of the energy is sufficient to ring an individual bell.

INSULATED STRAIN.—L. STEINBERGER, Brooklyn, N. Y. This insulated strain belongs to the class designed as "globe-strains." The invention admits of a variety of uses. It possesses great tensile strength, and admits of considerable adaptability in use. The structure is such that all of the metal parts may be made of drop-forged steel or other metal, thus obtaining a maximum of strength with a minimum of weight, little complication and an absolute certainty of insulation.

TELEPHONE ATTACHMENTS FOR TELEGRAPH LINES.—E. RUSSEL, U. S. Army, Washington, D. C. Capt. Russel in this case provides an apparatus capable of quick adjustment to a telegraph line at any point, so as to utilize the line for telephonic purposes without impairing its value for telegraphic purposes and without any interference to the telephonic communications from the sending of telegraphic messages. It consists in the particular arrangement of an inductance coil, a transmitter, a receiver, a local battery, a circuit interrupter, and a condenser.

Engineering Improvements.

ROTARY ENGINE.—J. WIECHMANN, Albany, N. Y. The object of this invention is to provide a new and improved rotary engine and pump which is simple and durable in construction, very effective and economical in operation, and arranged to utilize the motive agent expansively to the fullest advantage.

ROTARY ENGINE.—A. L. TREESE, Jennings, Oklahoma Ter. This engine may be used in connection with all fluids under pressure, such as steam, ignited gases, compressed air, and the like. The invention is characterized in a general way by a rotating multiple cylinder, the pistons of which move therewith, but have their rods in connection with a stationary element arranged eccentrically to the rotation of the axis of the cylinder.

Mechanical Devices.

ORE-CONCENTRATOR.—F. W. HARLOW, Eureka, Col. This invention relates to concentrators and slimers such as shown in a patent granted to Mr. Harlow in 1898. In operation it is very effective and comparatively noiseless. It is automatically governed as to the length of the stroke of the bed or pan to insure a thorough separation of the tailings from the ore and without undue jarring of the machine.

REVERSING MECHANISM.—C. J. COOK, Brooklyn, N. Y. The intention in this improvement is to provide in power transmission a reversing mechanism arranged to reverse at any time to cause rotation of the member to be driven in either a forward or backward direction and at the same time at an increased or diminished rate of speed.

APPARATUS FOR DEPILATING SKINS AND FURS.—A. BILLAUD, 42 Rue de l'Amiral Mouchez, Paris, France. To improve on other machines for removing "dog-hairs" without touching the down, the inventor in this device furnishes means for feeding the fur gradually forward so as to stretch it over the edge of the bar and brushes for depressing the down while the skin is stretched and folded so that only the dog-hairs project. Knives are provided for removing the hairs without touching the down.

FILLING APPARATUS.—W. H. SHEFFIELD, Hobart, N. Y. The design of the inventor is to provide an apparatus more especially intended for filling milk and other liquids into a number of bottles or other receptacles at the same time without danger of causing foam or froth during the operation, thus allowing proper filling of the receptacles.

ROTARY CHURN.—J. T. MARSH, Farmer City, Ill. This rotary churn is one of the class known as "working-body." A series of cream receptacles or carriers are employed which are mounted and temporarily secured upon the arms of the spider or skeleton, which is to be rotated by hand or power. There is no limit to its dimensions, yet it is particularly adapted for those who daily churn a small quantity of cream.

ADDRESSING-MACHINE.—H. L. GAY, Monticello, Fla. Mr. Gay in this invention has brought about the development of a machine that relates particularly to apparatus for severing printed names and addresses from strips of mailing-papers or the like. In the operation the strip of paper is drawn over the adhesive brush and fed through the front of the machine in an intermittent manner. The projected portion bearing a name will be severed by the cutter, and the blade projection will press such severed portion upon a wrapper. The machine may be provided with legs, or securely fastened to a table.

Railway Improvements.

MAIL-CARRIER.—E. HORST, Wooster, Ohio. In this case the invention relates to devices for transporting mail-matter between a dwelling and highway in rural districts, the object being to provide a device of this character of simple, inexpensive construction, by means of which delivery and collection of matter will be expedited.

SWITCH-OPERATING DEVICE.—J. M. WILBUR, Colorado Springs, Col. The design of the inventor of this device is to operate switches from a moving car, which may be a street-car, coal-car, mineral-car, or other vehicle running on the rails. As the devices are attached to the truck they will not be affected in operation by the upward and downward motions of the car.

Miscellaneous.

PIANO OR SIMILAR INSTRUMENT.—SARAH W. CLARK, New York, N. Y. The inventor provides a piano lid or top made of thin material and curved so that it will serve as a sounding-board to diffuse and give distinctness and effect to the musical sounds. The invention also provides improvements in the main sounding-boards.

TRANSPARENT DECORATION.—C. H. HEARTFIELD, New York, N. Y. The idea underlying this improvement is to provide a transparent article for the decoration of walls, ceilings, fireplaces, and the like capable of being used in the form of a tile or in strips of desired length and width and to so construct the article that a color or colored design will show at the outer or transparent surface in varied lines and with a mesh or textile effect. The back of the article when used as a tile may be so formed that it will key thereto the cementing material which is used for securing the tile to the wall.

CORKSCREW AND CORK HOLDER.—G. H. BRINTON, Elwyn, Penn. This device is well adapted for use to pull the cork of a bottle and also to retain the cork in the neck of the bottle if the cork is replaced and the holder adjusted for such a purpose. It is advantageous in securing the cork of a bottle holding ærated liquid, volatile spirits, or gaseous liquor and retaining any undecanted portions; and after the withdrawal of a tight cork, when the unused contents of a traveler's medicine or liquor bottle may be saved without spilling.

CARPET-FASTENER.—S. D. COSTENBADER, Lehighton, Penn. This fastener has but one screw or nail therein, which is to be embedded or driven into the stairs to clamp the carpet to prevent any movement of the material. The various portions of the device are so constructed that there is no liability of the parts being easily damaged, and the article is so simple that it may be placed in position for use by even unskilled persons.

BRICK-KILN.—J. PECK, Haverstraw, N. Y. By means of this improvement a brick-kiln may be constructed in which the draft through the arches will be more effective than in the usual construction, thus enabling fuel such as oil and soft coal to be used advantageously. A fire may be maintained throughout the length of the arch and the necessity of frequently changing the grate-bars is avoided.

BOTTLE-STOPPER.—H. GRAMLICH, New York, N. Y. This stopper is secured in the neck of the bottle by lugs therein. Its lower portion has a longitudinal bore and in the exterior of the upper portion are pockets which communicate with the bore through openings. The pockets have seats for ball-valves. Channels communicate with the pocket through recesses in the stopper, and when this is in place the bottle-neck will form the outer walls for the pockets and channels. The inner walls are so curved that the ball-valves roll easily. In discharging, the bottle is tilted. Then the ball-valves roll out of their seats, the liquid passes through the bore into the pockets and through the recesses and out through the channels.

HYDROCARBON-FILTER.—G. W. STEWART, Ticonderoga, N. Y. The particular object in this case is to produce a neat, cheap, and compact filter for general use, and mainly applicable to launches, automobiles, and other machinery, in connection with gasoline engines. Preferably the filter may be located at some point between the gasoline-tank and the needle-valve.

AWNING-FIXTURE.—J. F. KOHLER, New York, N. Y. This awning-fixture carries the bottom iron of the awning. The fixture is constructed in two parts—namely, a retaining-sleeve and a socket member—a pair of such parts being used in connection with each awning. The socket members may be readily connected with or disconnected from the retaining members and when an awning is down the socket members will engage with the uprights upon which the sleeves slide so as to prevent the wind from lifting the awning, thus avoiding the disagreeable rattling noises.

HYPODERMIC SYRINGE.—F. S. DICKINSON, Bayonne, N. J. This syringe is provided with a glass barrel and means whereby a metal plunger or piston can be used without packing or washers. The syringe is supplied with a tip so made that a special form of needle-hub may be used without washers and so that the tip when used with a washer will neatly receive the needle-hub.

MANOMETRIC GAGE.—C. SCHMITZ, 5 Calvin Street, Berlin, Germany. In instruments, heretofore used, for gaging the height of a liquid level it has been difficult to render the indications independent of the inner pressure of the receptacle and of the specific gravity of the liquid. In the present invention the height of the liquid is determined by the pressure of a liquid column, which is inclosed in a suitable appliance and thus rendered invariable.

BRICK.—G. HERING, New Rochelle, N. Y. The object in view in this invention is to obtain a brick designed for use as a face-brick on walls of buildings, chimneys, and the like, and arranged to protect the longitudinal and the vertical mortar or cement joints against rain, sleet, and the like and to insure quick running off of the water from the face of the wall to prevent interior dampness.

GAME APPARATUS.—E. BAWDEN, New York, N. Y. This apparatus belongs to the parlor game class. The invention consists primarily of a rectangular board, the corners of which are provided with roulette wheels and the center of which is furnished with an endless elliptical track for indicating the scores made by the several players.

TOY.—H. WITTMANN, Manitowoc, Wis. The inventor claims for his object the provision of a toy so arranged that by casting it upon a table or floor it may be caused to assume various shapes or forms indicating manifold objects, and also serve for elementary lessons in arithmetic, thus not only giving amusement, but having educational features.

LINK FOR FISHING-GEAR.—A. W. WILSON, San Francisco, Cal. This fishing-gear may be classified as belonging to links used for connecting the line or leader to the spoon, bait, or other lure in fishing-tackle. The object aimed at is to construct the link so that it may be opened at will and yet be held securely, so that it cannot be torn apart by the strains to which it is subjected.

DOOR CHECK AND CLOSER.—J. L. PEARL, New York, N. Y. According to the inventor's claim, the object is to provide a device which affords increased strength to the working parts, renders the adjustment of the motor-spring more convenient and reliable, and provides novel means for regulating the spring of an arm connecting the spring mechanism with a door-casement, so that the spring will always be in adjustment for efficient service.

DRESSER.—J. L. LARSON, Butte, Mont. This is particularly an improvement in hinges or mountings for swinging drawers, doors, etc., for dressers, although the hinges may be employed for house-doors, cabinet doors, and, in fact, for any swinging closure, the object being to provide hinges by means of which a drawer or other device supported thereby may be swung to the right or to the left as may be required.

PAPER-FILE.—L. W. ARMSTRONG, Walla Walla, Wash. Mr. Armstrong's contrivance is in the nature of a paper file or holder for bills, letters, deeds, and similar documents, where a number of papers are to be temporarily held in a package for selection, distribution or ready reference. It consists of a foldable cover having various leaf members for inclosing the bills and other papers so as to permit their headings to be quickly exposed and traversed without removing the bills from the holder.

TRUCK FOR MOVING BUILDINGS.—J. T. MARSH, Farmer City, Ill. The purpose of the inventor is to provide a truck for use in moving buildings and other objects which shall combine maximum lightness with easy draft and great facility for adjustment of horizontal dimensions, also adaptation to be hauled either end forward, to be easily turned and guided. It may be built at small cost, as well as easily dismembered for shipping and storing.

PROJECTILE.—W. PEPPERLING, Two Harbors, Minn. This projectile is of that order which is provided with one or more devices adapted to expand or project upon striking an object. The bullet proper is adapted to so act upon movable devices in rear of it as to cause them to jut laterally from the shell, and thus enlarge the hole made by the projectile in entering the body of an animal or passing through soft tissue or material.

SOUNDING TOY.—J. S. PATTEN, Baltimore, Md. Comprised in this invention are certain novel constructions and combinations of parts which produce a sounding toy, particularly in that class of devices in which a cap in a suitable holder is carried on the end of a cane-like staff and is exploded by striking it against the pavement.

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Inquiry No. 4077.—For makers of one and two horse power steam engines and boiler, latest patterns, complete fixtures, such as indicators, pumps, patent oilers, etc.

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Sealed proposals marked "Bid for Tail Race Tunnel" will be received by the undersigned until noon, May 11, 1903, for the construction of a tail race tunnel for the Toronto and Niagara Power Co., of Toronto, Ontario. Plans and specifications for this work are on file, and can be seen after March 30, 1903, at the company's offices at Home Life Building, Toronto, Ontario, and Niagara Falls, Ontario, or office of F. S. Pearson, No. 29 Broadway, New York, Room 220. The right is reserved to reject any or all proposals. Frederic Nicholls, Vice-President and General Manager, Home Life Building, Toronto, Ontario.

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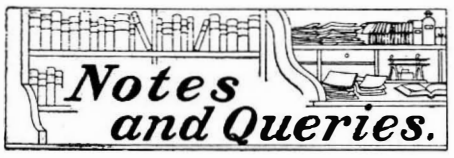

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(8943) J. M. asks for information regarding the process employed in getting iodine from kelp, and if there are other chemicals to be gotten from same. Also give the name of a reliable practical book on the subject. A. A good working description of the process of extracting iodine from seaweed would require a much longer account than we can undertake to give in a letter. There is no book, to our knowledge, devoted specially to this topic; but you can find full accounts in all the chemical technologies, under the heading Iodine. We can also refer you to our SCIENTIFIC AMERICAN SUPPLEMENTS, Nos. 149, 198, 246, 277 and 431, which we will be pleased to forward upon receipt of fifty cents. Practically all of the iodine on the market today is obtained as a by-product from the Chili saltpeter.

(8944) F. T. writes: I have heard from good authority that there is a mixture of acids that will make a fluid, and if put on paper it cannot be detected, but with a pair of glasses it is visible. Please inform me of the name and amount. A. We think you are laboring under a misapprehension. What you refer to are the so-called sympathetic inks, which are practically invisible, and are developed in various ways. You will find a long list of formulæ for sympathetic inks in our "Scientific American Cyclopedia of Receipts," pages 283 and 284, price $5 by mail. We also refer you to SUPPLEMENT Nos. 1114, 1280 and 1402; price 10 cents each.

(8945) D. McK. asks: If a windmill is 12 feet in diameter, what would be its greatest energy? A. . The power of a windmill depends upon the velocity of the wind and area of the mill exposed to the wind. The rule is: Area of the slats in the plane of revolution multiplied by the cube of the velocity of the wind in feet per second and the product divided by 4,000,000 equals the horse power. Thus a good-proportioned slatted mill 12 feet diameter in a 15-mile wind should give 3-10 of a horse power, and should pump 2,000 gallons of water 25 feet high per hour.

(8946) L. P. B. asks: Would it be possible to send a message the distance of a mile and one-half with the strength of batteries, induction coils, etc., mentioned in the article? The apparatus of both sending and receiving stations being located in the city? Would it be possible to increase the sending capacity of the apparatus (to a greater distance) by increasing the height of the mast? A. The apparatus for wireless telegraphy, as described in the SCIENTIFIC AMERICAN of September 14, 1901, is intended to send for a distance from one-quarter to one-half mile over water, as is explicitly stated in the article. To send over land requires much more force than over water. For a mile and one-half over land the aerial wires should be twice as high and the coil give at least a 2-inch spark, or better a 3-inch spark. 2. If it is necessary to increase the power of the apparatus for sending a message over the greater distance, how much and in what parts of the apparatus would the power have to be increased? A. A larger battery will be required for the larger coil. The relay need not be as heavy as 100 ohms, and the sounder need not be over 20 ohms. 3. Under the original conditions and strength of batteries, etc., would a 100-ohm relay, 40-ohm sounder, and ½-inch spark of coil, be sufficient for transmitter? If power is to be increased, please state additional cost for increased power also. A. We cannot give cost of instruments. For this information apply to dealers.

(8947) J. A. R. asks: 1. Is there ever, under any circumstance, such an occurrence as the suspension of gravitation? If there is not, how do you account for the falling of the barometer when the atmosphere is saturated with moisture? A. The density of water vapor is 0.6225 as compared with air; that is, any quantity of water vapor will weigh about five-eighths as much as the same quantity of air under the same temperature and pressure. Air containing water vapor is lighter than dry air. There is no indication anywhere of any suspension of gravitation. But the presence of water vapor in the air is not the principal cause of a low barometer in a storm, even if we might be allowed to call it a cause at all. The "low" in a storm is caused by the whirling motion of the air, which indeed constitutes the storm. The increasing moisture as the storm approaches a place, and the consequent fall of rain or snow, are due to the fact that the air drawn into and carried up in the low is cooled and has its capacity for retaining moisture diminished, and becoming saturated, parts with some of its water, which falls to the earth. For a full discussion of this important topic, you should read such a book as Davies' "Meteorology." 2. Would a siphon operate in a vacuum, viz., arranged so as no atmospheric pressure is exerted on the water drawn from or the exhaust of siphon? A. A siphon cannot operate in a vacuum. There would be no force to push the water up to the top of the tube, and there would, therefore, be a vacuum in the tube, just as there is in a barometer.

(8948) R. J. M. wishes to know what acids will dissolve cork, or can it be done some way? A. Cork is insoluble in any acids or other solvents, unchanged, in the way in which, for instance, sugar or salt will dissolve in water. By prolonged treatment with proper chemicals, it can be broken down and dissolved to a great extent, but its nature is then entirely changed.

(8949) S. C. H. asks for a formula for a liquid shoe polish that will give a patent leather luster, such as has been sold recently by the street fakirs. A. Dissolve ½ pound gum shellac in 3 quarts of alcohol; then add 1½ ounces of camphor and 2 ounces of fine lampblack.

(8950) W. T. O. wants to know if the electric motor with the 2-inch armature, described by C. D. Parkhurst, with 20 amperes at 6 volts, would develop ⅛-horse power. Could I use gravity cells (Crowfoot) to charge storage cells with, if I used twelve gravity cells 6x8 inches and four storage cells, the plates being 7¾x7¾ inches, three plates to each cell? Could I get enough current to run the motor for sewing machine? How much current would I get if I used five plates, same size, instead of three plates, or would smaller plates do? A. A motor which can carry 20 amperes at 6 volts will develop rather more than ⅛ horse power. Gravity cells can be used to charge storage cells, and ten gravity cells will charge four storage cells. If five plates are used instead of three in a storage cell, you will be able to draw about 5-3 as many amperes from the cell. The amperes given by a cell depend upon the area of the plates. A good result is 2½ to 3 ampere hours per square foot of negative surface in a storage cell, reckoning both sides of the plate.

(8951) G. B. M. asks: 1. Is there any practical process for waterproofing thin linen or cotton fabrics, without using oil or other materials which materially affect the appearance of the goods? In other words, can such fabrics be made waterproof and still retain their normal appearance? A. We advise you to consult the article on waterproofing in our "Cyclopedia of Receipts." One or other of the following formulæ on pages 590 to 592 will probably answer your requirements, viz.: 1, 9, 13, 19, 23, 24, 25, 29, 30, 33, and 34. Absolute waterproofing will not be attained, but with proper manipulation you can secure good results. 2. What is the process by which thin fabrics are attached to vulcanized rubber, so as to adhere firmly? Can this be done in such a way that the rubber will penetrate to at least the middle of the goods? A. This can be accomplished in several ways. The rubber can be softened by heat, and then passed, together with the cloth, between rolls which press the cloth into the rubber. Or the surface of the vulcanized rubber can be devulcanized by boiling in caustic potash or soda, then washing with dilute acid to neutralize the alkali and finally with water; then allow to dry. The cloth is then covered on one side with a solution of rubber, and the cloth and the partially devulcanized rubber are passed through rolls. 3. In vulcanizing rubber, is it possible to so protect certain portions of the same as to leave them softer and more flexible than the rest? If so, how is it done? A. We are not aware that this is ever done. We can suggest, however, the following: Prepare a solution of 1 part of sulphur chloride in 40 parts of carbon disulphide, and brush this solution in the parts to be vulcanized. Dry rapidly in a current of warm air; then wipe with a damp cloth. Dry, and repeat as often as necessary to properly vulcanize.

(8952) H. W. H. asks: 1. Is there more power in a two-cylinder compound engine than in a two-cylinder simple engine, same pressure, piston area, and expansion; the simple engine taking steam only at the first stroke? A. There should be no more power in a compound engine than in a double-cylinder engine with each cylinder of the same capacity as the high-pressure cylinders of the compound engine. Compounding is a question of economy. 2. If air or gas is compressed, is there a continuous heat from it, or only while it is being compressed? A. Compressed air and all gases generate heat only during compression. 3. Would there be more power in a gas engine if the heat of the explosion is used to make steam by spraying the inside of the cylinder, and would it keep it cool? A. A water spray in the cylinder of a gas engine is of very doubtful value, and is not considered practicable.

(8953) E. A. M. asks: Is the expansion of mercury, as in thermometers, directly proportional to the increase of heat causing such expansion? If the volume of a given quantity of mercury at 32 deg. F. be called 100 per cent, what per cent would represent its volume at a temperature of 20 deg. F? At 120 deg. F? A. The expansion of mercury is proportional to the change of temperature. The equation for obtaining the volume at any temperature which was used by the International Committee of Weights and Measures is $Vt = 1 + .0001817792t + .0000000001175t^2 + .000000000035116t^3$. In this formula 1 is the volume at freezing, or 0 deg. Centigrade; Vt, the desired volume at t deg. From this equation you can easily determine the percentages you desire, since 20 deg. Fahr. is 6.7 deg. C., and 120 deg. Fahr. is 48.9 deg. C.

(8954) D. E. D. asks: What are the lowest and the highest temperatures reached, and under what conditions have they been reached? A. The lowest temperature yet attained was reached by Prof. Dewar, when he liquefied and afterward froze hydrogen. He gives the following data: Hydrogen boils in the open air at —252.5 deg. C. (—486.5 deg. F.) It freezes at —258 deg. C. (—496.4 deg. F.) By its own evaporation this is reduced to —260 deg. C. (—500 deg. F.) This is the lowest temperature ever obtained for a sufficient time to measure it. The highest temperature obtained is in the electric furnace by Moissan in his researches. This may be stated as between 6,300 deg. F. and 7,000 deg. F., since it is between these points that carbon volatilizes. An extremely high temperature is obtained by heating a mixture of aluminium powder and iron oxide or chromium oxide powder, equal parts. The aluminium takes the oxygen from the oxide so violently that a temperature higher than that of the oxyhydrogen flame is reached. The oxyhydrogen blowpipe gives about 3,800 deg. F.

(8955) B. M. asks: Will you kindly let me know whether the theory that there exists a "repulsive force" between the molecules of matter is correct? If not, what power makes the molecules of a gas "beat" against the walls of the vessel in which it is inclosed? A. There is no repulsion between the molecules of any gas, unless it be those of hydrogen. All other gases act as if there was a slight attraction between their molecules. The force which causes gases to exert pressure against the sides of the vessels in which they are confined is heat. If any gas is cooled sufficiently, the pressure ceases and the gas turns into a liquid. The theory by which the behavior of gases is explained is called the Kinetic Theory of Gases.

(8956) W. S. E. asks how brass or copper plates may be treated to imitate gun metal; also if you publish a SUPPLEMENT containing the design of a small transformer of about 125 watts capacity, with primary voltage 250 volts and 3,000 alternations to give a secondary voltage of 125 volts? A. An easy way to blacken brass is by means of the following solution: Take nitrate of copper, 1 part, and ammonic hydrate, 2 parts. Dissolve the copper in the ammonia water. Clean the brass, and leave it in the solution till the desired color is reached. Dry, and rub with wax or vaseline to polish if desired. We have not published any plans for winding a transformer. Plans for one are to be found in the book "Electrical Designs," which we can send you for $2 by mail.

(8957) L. B. asks how much pressure or power is exerted on a board 1 foot square immersed perpendicularly in a stream flowing 3 miles per hour? What I wish to know is the size necessary to make a surface which will be equivalent to one (theoretical) horse power when immersed in stream. A. The pressure on a square foot of surface held in a 3-mile-per hour stream will be 0.129 pound. A wheel to generate one horse power in such a stream must have a peripheral velocity equal to one-half the velocity of the stream for best effect. It will therefore require to have the blades of 15 square feet each.

(8958) F. B. asks: 1. How much heavier or lighter is gasoline gas than air? A. Gasoline gas is slightly heavier than air. 2. If a gasoline stove or lamp is placed in a small, close, and very warm room, would the gasoline evaporate through the opening which admits air to the supply tank, mix with the air of the room, and explode? If not, why? If it would, how much ventilation and how low temperature would be required to make an explosion impossible? A. Gasoline does not evaporate and pass through the small ventholes of a lamp or supply tank in quantities sufficient to make an explosive mixture with the air of a room. Very little ventilation of a room is needed, only enough to prevent the odor of gasoline. 3. If an explosion occurred, would it be very serious? A. An explosion of gasoline gas would be very severe. It would wreck a house. 4. I have read that it is dangerous to subject acetylene gas in a lighting plant to a greater pressure than a six-inch column of water would produce. If this is true, why? How could it explode in the pipes before being mixed with air? If not true, how much pressure would be safe? A. Acetylene gas apparatus is not made for excessive pressure, as in general use. Pure acetylene at ordinary pressures is not explosive.

(8959) W. M. G. asks: In conversation with a friend, he made the statement that the great pressure of deep-sea water would overcome gravitation; that a cannon ball or any heavy weight would sink so far and stop, and also stated that telegraph cable would not lie on the sea bottom in deep sea for the same reason. Is that true? A. According to the best figures at our command, sea water is compressed 44 millionths by a pressure of 15 pounds per square inch. As the pressure increases, the compression is not proportionately so great as this. The tests have been carried up to three tons per square inch. At one ton per square inch the compression was 0.00696; and at three tons, it was 0.00719. This is but little more than for one ton. These facts show that water is nearly incompressible, or is compressed very much less than most substances which will sink in water. It is easily seen from this that a body which begins to sink in the sea will continue to sink till it reaches the bottom. Its density is greater than sea water at the surface of the ocean, and it will become denser more rapidly than the water as it goes down in the water. There can be no place where its density will be equal to that of the sea water, and hence no place where it will cease to sink till it reaches the bottom. The depths of the ocean are not occupied by floating bodies, wrecks, etc., tossing about in the water. They are dark, motionless, barren, dead, and telegraph cables lie buried in the ooze which covers the ocean floor.

(8960) E. O. M. writes: Some time ago, while inspecting a 220-volt direct-current motor, I made the remark that dynamos and motors are almost identical in construction. The man to whom I was talking was a representative of an electrical company, and said there was no more resemblance between a dynamo and motor than between black and white. He said a motor would never act as a generator unless the leads were changed. I affirmed that a series motor if revolved in the opposite direction will act as a generator, while a shunt-machine acts either as a motor or generator without the leads or direction of rotation being changed. Which was right? Is the following true? A spark will jump a foot in air of ordinary density rather than 0.01 inch in a nearly perfect vacuum. A. You are quite right in your statement regarding the reversibility of dynamos and motors. The fact is said to have been an accidental discovery, and to have led to the use of electric motors. A discharge in a partial vacuum, such as that of an incandescent lamp globe, will take place over a much greater length than in air of ordinary density. However, in a perfect vacuum no discharge can take place.

(8961) T. A. H. asks: 1. How do astronomers account for the retrograde motion of the moons of Uranus? What is the inclination of the poles of the planet to the plane of his orbit? A. The moons of Uranus revolve in orbits which are very nearly perpendicular to the plane of the ecliptic. The position of the axis of the planet to the plane of the ecliptic is not known, since there are no spots upon the planet by which its rotation can be determined. 2. What is the latest conclusion of astronomers as to the conditions on the surface of Mars? Where can I get full information? Proctor, in "Other Worlds than Ours," describes this planet as being largely covered with seas and oceans. Is not this view now discredited? A. You will find the modern view of the physical condition of Mars in any modern astronomy. Todd's "New Astronomy," or his later book, "Stars and Telescopes," will give you a reliable account. Briefly, Mars is regarded as a planet which has a thin atmosphere, and whose water is nearly gone. Most points of its surface can be reached by a Martian without using a boat. The details of this topic cannot be given in a note.

(8962) H. F. T. says: 1. What weight is a large American locomotive? A. The largest American locomotives weigh about 230,000 pounds; with tender, 320,000 pounds. 2. What is the capacity of a large American box car (freight)? A. The carrying capacity of new style large box cars is from 40 to 55 tons. 3. What number of loaded freight cars can a large freight engine haul? A. The largest haulage capacity of heavy engines is about 3,000 tons, say 40 full-loaded cars. Trains of 100 empty cars are frequently hauled by a medium engine. 4. What is the average daily run for one passenger engine, on transcontinental trains, i.e., the distance between stations at which engines are changed? A. From 150 to 250-mile runs are made, but much longer under special conditions. 5. Have American passenger trains made faster time than those in England? A. We understand the fastest time on record has been made in the United States.

(8963) F. H. F. writes: To start a gasoline motor in cold weather, that is fixed by a contact-breaking device, is frequently a difficult matter. I have found that by removing the firing apparatus (which takes but a moment with my motors) and warming it well over a gasoline or alcohol flame, so as not to deposit soot, the motor will start instantly. In case the parts cannot be removed easily, the flame from a plumber's gasoline torch held against the firing apparatus would answer the same purpose.

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NEW BOOKS, ETC.

ANATOMIE DU GASTER DE LA MYRMICA RUBRA. Par Charles Janet. Paris: Georges Carré et C. Naud, Editeurs. 1902. Pp. 68.

MANUAL FOR RESIDENT ENGINEERS. Containing General Information on Construction. By F. A. Molitor and E. J. Beard. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. 1903. 16mo. Pp. iv, 118. Price $1.

During the construction of the Choctaw, Oklahoma & Gulf Railroad Company's line across the State of Arkansas in 1899, the first fifty pages of this book were written by the authors and published in blue-print form as instructions to resident engineers for the purpose of obtaining uniformity of method in work and results. After the road was extended, so that personal supervision was rendered difficult and slow, the authors revised the body of the book and also the standard specifications, which, together with the tables of level cuttings, were added to the original instructions and published in book form for the railroad company's use. As no pocket-book or manual bearing upon the particular field covered by the original instructions has heretofore been published, the work should do at least something toward simplifying and standardizing the work of the resident engineers in general.

IRRIGATION INSTITUTIONS. By Elwood Mead, C.E., M.S. New York: The Macmillan Company. London: Macmillan & Co. 1903. 12mo. Pp. xi, 392. Price $1.25.

Mr. Mead assures us that this work is based on twenty years' experience in the development of irrigated agriculture in the arid West. In the work that lies before us these years of experience have been concentrated into some fourteen chapters, dealing with the subject both from the agricultural and technical side, as well as from the legal side. The changes wrought by irrigation in the last half century have been such that a good book on the subject should be welcomed.

AMERICAN ELECTRIC AND AUTOMOBILE PATENTS MONTHLY. Compiled by James T. Allen, Examiner United States Patent Office, Washington, D. C.: American Patents Publishing Company. Price $5 per annum.

Mr. Allen has undertaken the task of preparing a compilation of the patents included in over four hundred subdivisions of the Patent Office classes. The publication contains digested patents covering the subjects of acoustics, electro-chemistry, electric lighting, electric railways, electric signaling, electric steering, electric conductors, therapeutic electricity, electrical motive power, special applications of electricity, telegraph, and telephone improvements, motor vehicles and attachments, and air and gas engines. Mr. Allen has published the drawings and the claims of each patent. Not the least valuable feature of his work is an index giving the number, name, and date of references cited in examination of applications. That a publication of such character should be of value to patent lawyers goes without saying.

INDEX OF INVENTIONS

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April 14, 1903,

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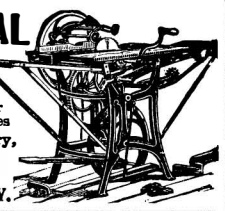

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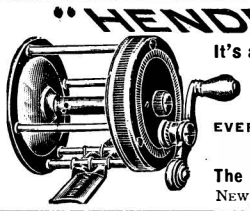

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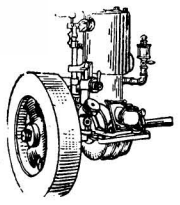

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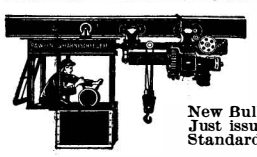

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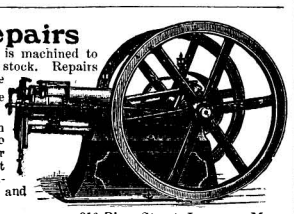

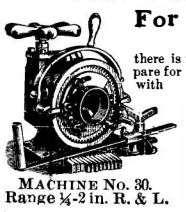

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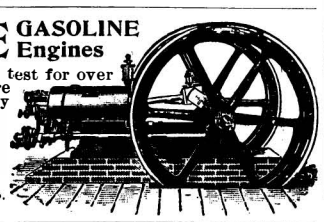

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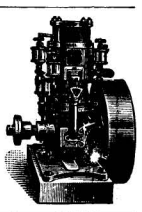

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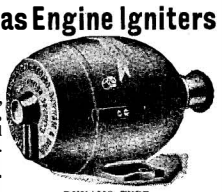

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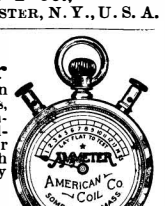

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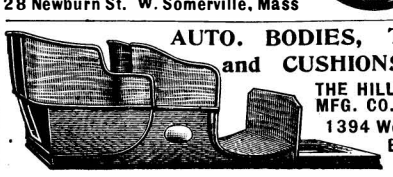

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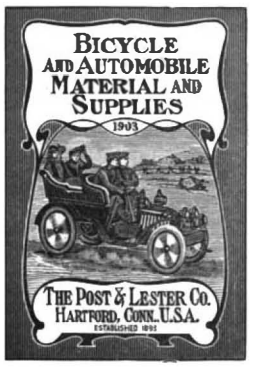

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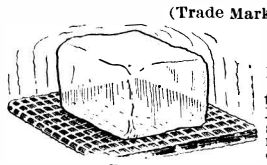

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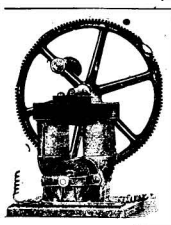

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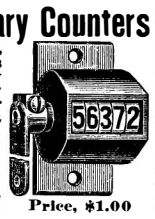

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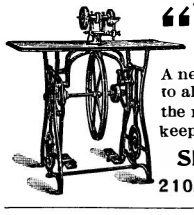

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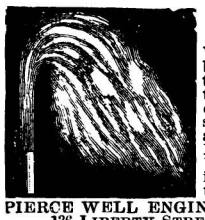

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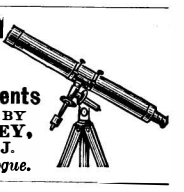

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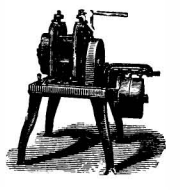

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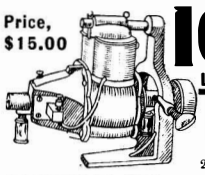

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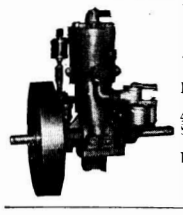

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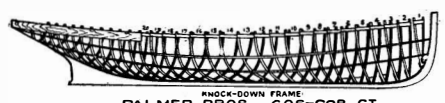

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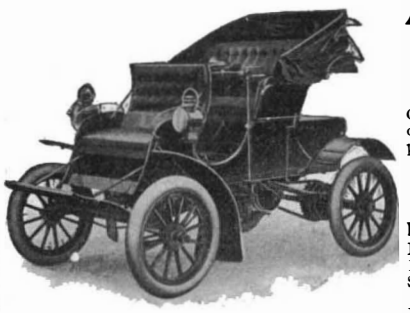

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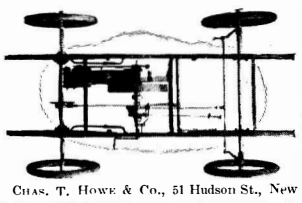

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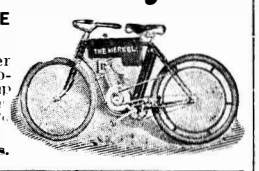

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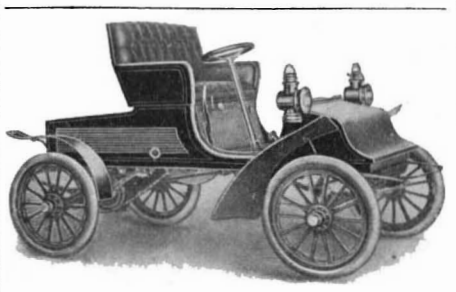

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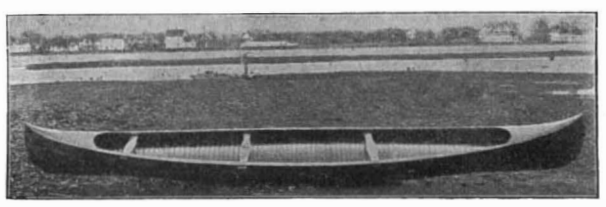

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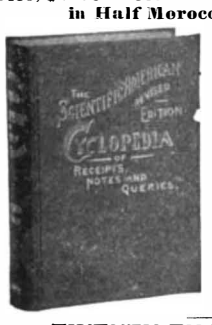

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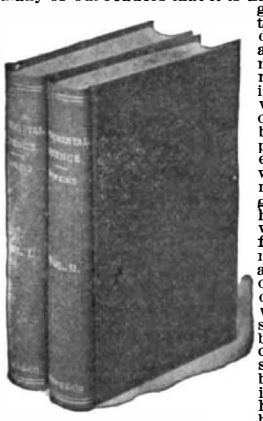

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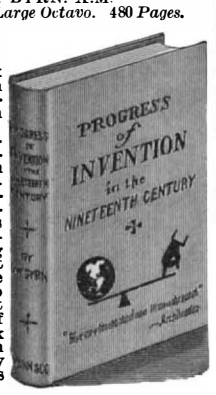

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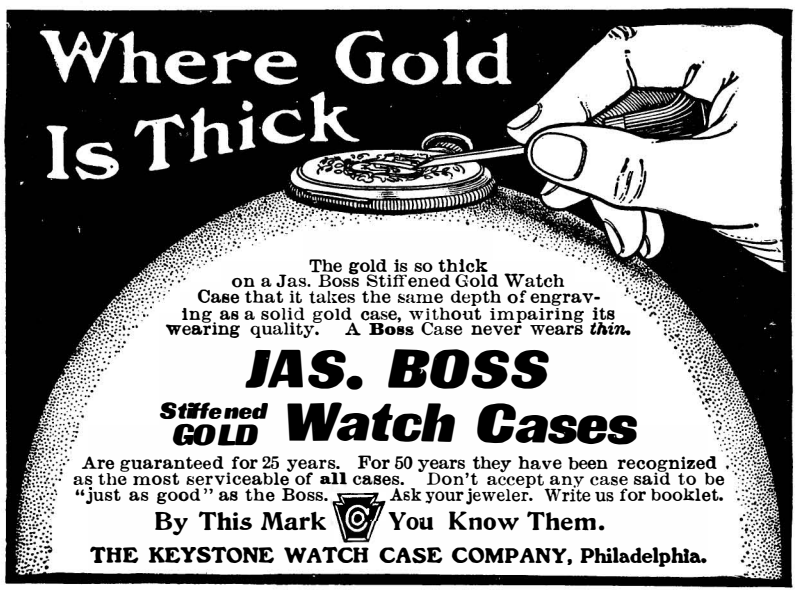

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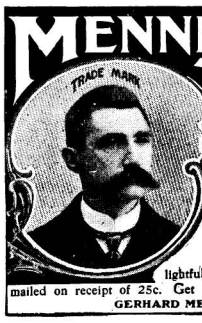

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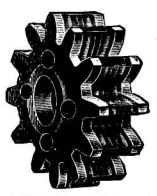

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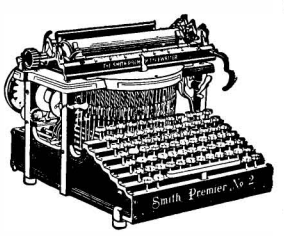

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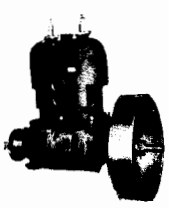

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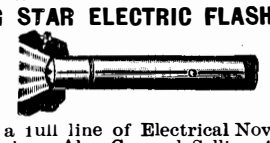

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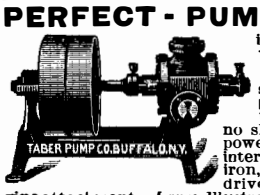

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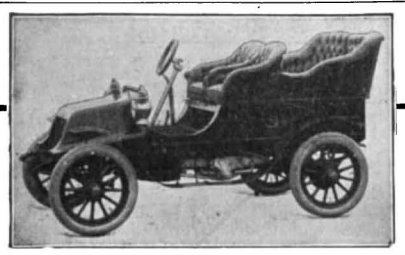

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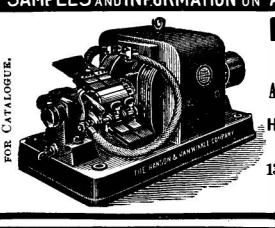

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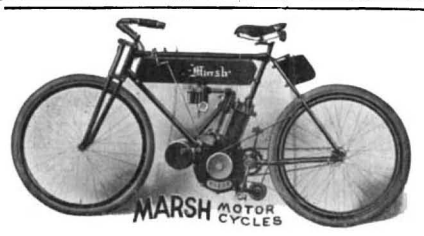

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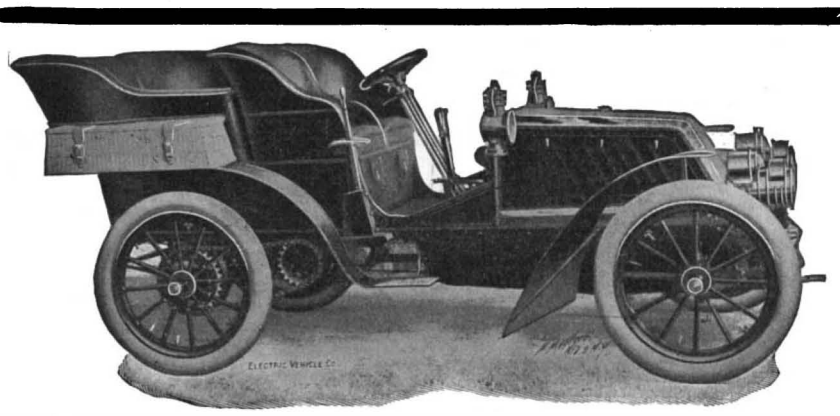

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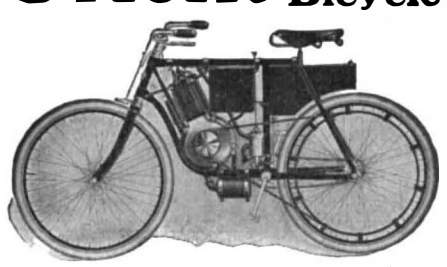

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